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ANNIVERSARY OF SAULT STE. MARIE CANAL.

Congressman Carlos D. Sheldon of the upper peninsula of Michigan has introduced a joint resolution in the house of representatives at Washington to provide for the commemoration of the semi-centennial anniversary of the commencement of the construction of a canal at Sault Ste. Marie, Mich., which occurs on June 4, 1903. Senator McMillan of Michigan has also sent an abbreviated resolution to the same purpose to the committee on commerce of the senate, but the language of both will undoubtedly be made identical. When the subject was brought to the attention of Secretary of War Root he expressed himself as warmly in favor of the idea but seemed disinclined to become the responsible director of the details to carry it into effect. This objection was a reasonable one, but with the creation of the joint commission outlined in the resolution to take charge of the exercises the secretary would share the honors with the commission without incurring the labor of preparation. Considerable interest is manifested in the anniversary in the lake region, where the importance of Sault Ste. Marie canal is well understood. The joint resolution reads as follows:

"To provide for the commemoration of the semi-centennial anniversary of the commencement of the construction of the ship canal between Lake Huron and Lake Superior at the falls of the St. Mary's river in the state of Michigan, occurring June 4, 1903.

"Resolved by the senate and house of representatives of the United States of America in congress assembled, that the secretary of war be and is hereby authorized and directed to cause suitable measures to be taken by and with the advice and consent of the commission hereinafter created, to commemorate the first half-century anniversary of the commencement of the construction of the original ship canal at the falls of the St. Mary's river in the state of Michigan, which will occur on the 4th of June, 1903.

"First: By the placing of a bronze tablet in a suitable position in the masonry now occupying the site of the locks built in 1853-4, or on a monument to be placed contiguous thereto, with the names inscribed thereon of the state officers, contractors and engineers officially connected with the undertaking, and including the dates of the commencement and completion of the work.

"Second: By the compilation and publication of an illustrated memorial volume, containing biographical notices of the persons whose names appear on said tablet, with full historical data relating to the conditions, promoting, industrial and commercial results pertaining to said canal, and to its subsequent enlargement, growth of commercial utilization, or otherwise.

"Third: By co-operating with the state of Michigan in such local commemorative exercises as may be jointly arranged, and to which representatives of the several states and provinces of Canada, bordering on, or contiguous to, the basin of the St. Lawrence river, and of the municipalities therein, benefited by the commercial facilities of the canal, are to be invited.

"Resolved: That for the expenses incident to the execution of said measures, the sum of $50,000 is hereby appropriated.

"Also resolved: That a special joint committee of the senate and house of representatives be and is hereby constituted, to be known as the Great Lake Canal Semi-Centennial Commission, to consist of five senators, designated by the president of the senate, and eight representatives, appointed by the speaker of the house, to which commission the secretary of war shall refer the details of the measures mentioned in the preceding resolution, together with the auditing of the expenditures therefor, to be certified by the chairman and secretary of the commission upon due examination by a sub-committee designated by it for that purpose."

The Sault Ste. Marie canal is a subject of international interest in that its commerce is the largest of any of the great ship canals of the world—in fact so far does it outstrip all the rest that there is no canal justly entitled to be even second to it. An article which is published elsewhere in this issue goes into the minutest detail regarding the commerce of this canal during 1901 and will be found to be mighty interesting reading. While the senators and representatives of the lake states may be said to be primarily interested in the anniversary, still Sault Ste. Marie occupies a position of sufficient strategical importance commercially to claim the attention of the entire nation. It would be eminently proper, however, that the lake senators, if such they may be called, should be upon the commission, comprising Senators Hanna, McMillan, Nelson and Quarles; and of the members of the house those whose districts touch upon the great lakes, notably, the author of the resolution, and Mr. T. E. Burton, the chairman of the committee on rivers and harbors. Others spoken of are Mr. Dalzell of Pittsburgh, a city which undeniably owes its great industrial supremacy to the Lake Superior ores; and Mr. William P. Hepburn of Iowa, whose native state sends millions of bushels of grain annually through the Sault Ste. Marie canal. With the prestige of such a national commission, Michigan would make the anniversary of its great canal an event to be remembered. No opposition is anticipated to the adoption of the joint resolution, but undoubtedly the senators and representatives in the lake region would like to hear from their districts upon the subject. It has been urged also that the boards of trade of the various large lake cities adopt suitable resolutions and forward them to congress.

The contract made by the state of Michigan with the contractors for building the first canal at Sault Ste. Marie, as now on file in the state archives, is an interesting document. The contract was made with individuals of which Joseph P. Fairbanks of St. Johnsbury, Vt., was the first one named, but a proviso in the law allowed the contract to be assumed by a company, chartered by another state, as the constitution of Michigan forbade its legislature to grant special charters for any purpose. The state of New York came to the front with a special act, incorporating the St. Mary's Falls Ship Canal Co. with a capital of $1,000,000, and it was under this organization that the canal was built. Its president was Hon. Erastus Corning, of Albany, the first president of the New York Central Railroad Co. The vice-president was John W. Brooks of Detroit, general superintendent and afterward president of the Michigan Central railroad. The secretary and treasurer was Hon. John V. L. Pruyn, the legal counsel of the New York Central, and for a long time the chancellor of the University of New York. Besides these directors, others were John M. Forbes, a leading capitalist of Boston, and father of the first president of the Bell Telephone Co. Hon. Erastus Fairbanks of the celebrated scale manufacturing firm of Vermont, subsequently governor of that state and one of the most efficient of the "war governors," so styled during the civil war. John F. Seymour, a distinguished citizen of Utica, N. Y., and brother of Horatio, another of the "war governors," as the executive of the state of New York at that period, afterward Democratic candidate for the presidency of the United States, and James F. Joy, the distinguished lawyer of Detroit, who was the counsel for the company in Michigan. While among the incorporators was August Belmont, the father of the capitalist of that name, now financing the subway rapid transit of New York city, George Griswold, the leading New York tea importer of those days, and others of note too numerous to mention. The promotor and organizer of the corporation and executive manager and engineer of the construction work, was Charles T. Harvey, who was previously in confidential business relations with the Fairbanks firm, and who influenced them to take a leading part in the contract. It is also worthy of note that the last Democratic governor, McClellen, of the state of Michigan, was the one to sign the contract, or rather the lieutenant governor, Parsons, who took McClellen's place when he resigned to enter the cabinet of President Buchanan as secretary of the interior. The first Republican governor, Kinsley S. Bingham, took office in time to inspect and approve the canal when completed, and Mr. John Burt became its first state superintendent.

ORE CONTRACTS AT 80 CENTS.

Contracts to move a considerable block of ore from the head of the lakes have been made at 80 cents during the past few days, which is the same as the contract rate that prevailed last year. Quite a flurry was caused among the vesselmen when the United States Steel Corporation endeavored to establish a rate of 75 cents from the head of the lakes, which means 65 cents from Marquette and 55 cents from Escanaba. The rate was naturally not accepted. In the face of it minor shipping interests covered a block of 500,000 tons at the 80 cent rate. This was on Friday last. On Tuesday of this week Corrigan, McKinney & Co. chartered vessels to carry 1,300,000 tons of ore from ports at the head of the lakes at 80 cents. This makes a total of 1,800,000 tons at the 80 cent rate. Among the owners who have taken 80 cent tonnage are J. C. Gilchrist, Capt. John Mitchell, Hutchinson & Co., W. A. Hawgood & Co., W. C. Richardson, W. H. Becker, Capt. J. H. Bartow, Capt. John Corrigan and Capt. James Corrigan. The contracts that were made by Corrigan, McKinney & Co. run up to Nov. 20. Last year contracts made by the United States Steel Corporation were for the full season.

In addition, contracts for two blocks of ore of 50,000 tons each, to be shipped from Escanaba, were made at 60 cents. The bulk of the ore already chartered will be carried in medium sized vessels as the shippers have not the accommodations to take care of the greater ships at all times. The vesselmen believe now that they have the situation well in hand, though the Steel Corporation and other shippers have not modified their original offer of 75 cents. The shipping manager of the Steel Corporation states with confidence that vessels will be signed at that figure when the time comes. In all other lines the freight market is very quiet. The lumber men have not chartered tonnage nor has the Lumber Carriers' Association taken any action in regard to carrying charges.

The United States Coal Co., of which Messrs. M. A. Bradley and Robert R. Rhodes of Cleveland are the principal stockholders, has just closed a deal for some of the most desirable coal land in the state. The work of developing the property will begin at once. The coal fields are reached by a number of railroads, including the new one which is under construction by Calvary Morris and others of Cleveland. About 18,000 acres are controlled, embracing 230 farms. The land is in the vicinity of Steubenville.

A special dispatch from Washington says: "A bill in the interests of light-house keepers has been introduced by Representative Maynard. It makes the salaries of the keepers $50 a month and assistants $40, but the more important feature is the provision that after ten years' continuous service keepers and assistants who become disabled shall be pensioned on half pay. Discretionary power is given the secretary of the treasury to determine who shall be entitled to pensions."

J. M. Longyear of Marquette had a hearing before the house rivers and harbors committee at Washington this week to urge an appropriation for a survey in order to determine the cost of building a breakwater in the bay near the harbor, so as to establish a harbor of refuge. Senator McMillan also received a telegram from President Livingstone of the Lake Carriers' Association, stating that a harbor of refuge is greatly desired at Marquette.

It is now claimed that the big schooners are more in demand at present than barges for carrying coal and more of the former have been built than the latter in Maine ship yards. No barks or barkentines have been built in recent years and no brig in the eastern part of the country since the Telos was launched at Bangor, Me., in 1883.

RHECLAIR AND NOMA.

Messrs. Tams, Lemoine & Crane, naval architects of New York city, are the designers of two new fine steam yachts, the Rheclair and the Noma. They are both being constructed by the Burlee Dry Dock Co. of Port Richmond, S. I., and were launched during the present week. A description of the Rheclair is as follows: 215 ft. length over all; 183 ft. length on the water line; 27 ft. beam, molded; 13 ft. draught. Triple expansion engines of 2,000 H.P. have been placed on the yacht. There are six cylinders in all, two high pressure 14 in. diameter, two intermediate pressure 22 in. diameter, and two low pressure 36 in. diameter. The stroke of the piston is 24 in. The vessel is fitted with four Almy water-tube boilers. The yacht is twin-screw and constructed of steel throughout. The speed guaranteed by the designers has been placed at 17 knots and there is no doubt but that the yacht will develop this speed on her trial. There are seven state rooms, each fitted up with a separate bath room. These rooms are in addition to the usual dining, sitting, smoking and music rooms. There is a large and modern electric light plant on board the Rheclair. It is complete in every respect and in addition to all inside lights a search-light is fitted with rainbow and decorative belts. The owner of this trim yacht is Mr. D. G. Reid. He is one of the directors of the United States Steel Corporation.

The steam yacht Noma is being constructed by the same builders as the Rheclair and is another fine specimen of the handiwork of the firm of Tams, Lemoine & Crane. She is a steel, twin-screw vessel and is built very strong. Her length is 263 ft. over all and 226 ft. on the water line. Her beam, molded, is 28 ft. 6 in. and her draught is 14 ft. She is fitted with triple-expansion engines of 4,000 H.P. There are eight cylinders, two high-pressure of 17 in. diameter, two intermediate pressure of 27 in. diameter and four low pressure of 32 in. diameter. The stroke of the piston is 24 in. There are six Almy water-tube boilers. The speed guaranteed by the architects is 18½ knots. There is an ice machine which has a capacity for turning out three tons of ice every day. The electric light plant is most complete, being similar to that installed on the Rheclair. The deck house is continuous and contains the dining, smoking, music and other rooms. The chart house and social rooms are above it. There are eight elaborately furnished state rooms, each with its respective bath room. This handsome yacht is being constructed for Mr. W. B. Leeds, president of the Chicago, Rock Island & Pacific Railroad Co.

LAUNCH OF THE MONTREAL.

The steamship Montreal, building at the ship yard of the Bertram Engine Works Co., Toronto, Can., for the Richelieu & Ontario Navigation Co., was launched last week. The Montreal is 340 ft. long and of the same general design as the Kingston and the Toronto. The engines include a three-cylinder, three-crank inclined triple-expansion engine, the diameter of the cylinders being 32, 53 and 88 in. respectively, with a stroke of 66 in. The high-pressure cylinder is in the middle and its crosshead works in the air pump. The engine is estimated at 3,000 H.P. The paddle wheels are 25 ft. in diameter, and have eleven feathering curved steel buckets each. This form of engine was introduced three years ago by the Bertram company in the steamer Toronto, and gave great satisfaction. There are six Scotch type boilers, each 11 ft. in diameter and 12 ft. long, with two Morison corrugated furnaces, 42 in. diameter, fitted with the Howden down draft system. The working pressure of steam will be 185 lbs. The electric light plant will furnish current for 1,200 incandescent lamps, and the pumps will supply running water to every state room. There will also be steam steering gear, steam winches forward and aft, steam windlass, and steam heat in the cabins.

The ship will have 260 staterooms, and the decoration of the first-class saloons will be of unusual beauty.

EARLY FIND OF COPPER.

Editor Marine Review:—Peter White's narrative, which I have read with great interest, brings to mind a little ancient history of an early find of copper on Lake Superior. Sometime during 1842 Anson Eldred of Detroit, Mich., was coasting along the American shore in a large Mackinac batteau bound for the Sault on his way home from a cruise out west looking for pine and hemlock timber. While camping at the mouth of Ontonagon river he was told by an Indian and half breed that copper could be found a short distance up the river. He went up and found a chunk sticking out from a solid ledge of rock. The piece weighed more than a ton. It was connected to the rock by a strip of only about 6 in. diameter. He concluded to make an effort to get it off and hauled down to the beach. After a week of hammering and battering with heavy log rams he finally got it off. He then built a drag and started to haul the chunk to the beach by Indian and half-breed power. He found a dozen claimants among the natives. He finally settled up all claims and got the chunk in his boat and started for the Sault, which he reached in due time, but too late to get his find shipped to Detroit. In the spring of 1843 I shipped on board the schooner William Brewster. She traded between Detroit and the Sault. This was my first trip to that region. We took on board Eldred's copper chunk and carried it to Detroit. The chunk made a great flurry among the people, hence was much talked about. The custom house authorities concluded that the chunk belonged to the government. They captured it and sent it on to Washington, D. C. Years afterwards I saw the selfsame chunk at the Smithsonian institute. The exact weight was a little over 2,200 lbs. Mr. Eldred was a long time in getting his expenses paid by the government, but finally settled it satisfactorily. In the fall of 1843 I was second mate of the schooner Benjamin Barton, which belonged to Mr. Eldred, and from whom I learned all the particulars of his adventure on Lake Superior.

S. R. KIRBY,
New York.

The tonnage of vessels entered at ports in the United Kingdom from foreign countries and British possessions, with cargoes, during the year ended Dec. 31, 1901, amounted to 36,338,134 tons, and the tonnage cleared to 43,378,486 tons, as against 36,195,010 tons entered and 43,742,219 tons cleared in the year 1900. With regard to the coasting trade, the tonnage entered with cargoes during the year 1901 amounted to 30,557,764 tons, and the tonnage cleared to 30,216,505 tons, as against 30,761,937 tons entered, and 30,323,260 tons cleared in the year 1900.

PASSENGER TRAFFIC BETWEEN NEW YORK AND EUROPE.

An official announcement in tabular form has been made in New York showing the number of passengers landed at that port from the vessels of the various companies in the transatlantic trade during 1901. It is no exaggeration to say that the totals are enormous. The following are the figures:

Name of Company.	Cabin Passengers.	'Tween-deck Passengers.	No. of voyages.
North German Lloyd	20,403	76,804	86
Hamburg-American line	20,524	63,223	106
Compagnie Générale Transatlantique	6,241	32,793	54
Red Star line	18,167	30,483	52
White Star line	5,595	25,960	66
Holland-America line	538	24,690	51
Navigazione Generale Italiana	2,557	24,580	27
North German Lloyd (Mediterranean)	17,783	19,943	36
Cunard line	70	16,132	57
Anchor line (Mediterranean)	453	15,337	34
Hamburg-American line (Mediterranean)	33	14,165	25
Fabre line	493	13,505	29
La Veloce	12,110	12,511	14
American line	158	12,445	39
Prince line	7,577	6,756	17
Anchor line (England)	947	4,408	40
Scandinavian American line	104	2,607	20
Linha de Vapores Portuguezes	106	1,814	10
Empreza Insulane de Navegacao	53	1,751	5
Compania Transatlantica	2,386	1,114	8
Allan State line	4,194	....	30
Atlantic Transport line	372	1,880	57
Others	128,143	438,868	24
		567,011	887

It will be observed that the North German Lloyd stands at the head of the entire list with 22 per cent. of the whole number of passengers, while the White Star line is first among the English companies.

THE QUESTION OF LAKE LEVELS.

Buffalo, Feb. 11.—I am sorry to learn that the government authorities on the lakes are engaged in changing what is commonly called the zero mark on several of the lakes, dropping the low-water reference planes, as it is called officially, to what now happens to be nearer the actual low level of these lakes. I am sure that there is plenty of work that needs doing much more than this and I am also sure that the average lake navigator will hardly thank the authorities for this sort of assistance. Of course I am not exactly a "high authority"in the case, either as navigator or engineer, but I have plenty of expert opinion to bear out what I have to say in objection to the move.

In the first place there is going to be a big job for the printer if the sounding readings are all to be changed, as all the lake charts will have to be made over. This is really a big item in the reckoning, though it would be warranted if there was much to be gained by the proceeding. I am persuaded that there is not much advantage possible. If the actual lake level was constant it would be a different mater, but far from essential even then. But when the daily level changes a matter of 7 ft. now and then, when the water is piled up or driven out by a storm the most serviceable zero point for reference to a chart is one that is well known and it matters not a whit where it is located.

Take the latest chart of lake levels. It will be found that in 1867 Lake Ontario fell about 4 ft. and that it fell 3 ft. as late as the summer of 1891. Of what account can any particular zero point be in such a case. Certainly one is just as good as another, so long as it is known. With a new one there will for a long time be in the lake captain's mind two standards, just as there was old and new style in the calendar after the adoption of the Gregorian to take the place of that of Julius Cæsar. In that case, though, there was a very valid reason for the change, as it neutralized an error that was constantly carrying our reckonings further astray.

There is a claim that the engineering operations at points in or near the outlets of several of the Great Lakes has permanently lowered their levels. This seems to be borne out by the fact that Lake Superior which has been let alone for the most part, is higher now than it was forty years ago. Still the decline of that level was 3 ft. during the year and a half following the August of 1869, a heavy decline following directly on a great rise. On the other hand the decline of Lake Ontario is about as great as of any other lake and there has been no outlet-cutting there that I ever heard of.

The fact is that we really know very little of the causes of change of lake levels. There is plenty of theory, but it is for the most part too conflicting to be of any value as a prediction. For instance it is by no means a rule that the winter rain and snow fall uniformly raises the levels and the summer evaporation lowers them, though these influences must exist and go for something in the general reckoning, though the chart shows there is a much more potent influence at work at the same time. It is pretty safe to place the low point of the year in February or March and the high point in August or September, but it is the change that takes several years to complete, or is several times as pronounced as the average, that most concerns a navigator and nobody seems to have any key to it yet.

Then there is the move to restore and maintain levels by means of dams at lake outlets. We do not hear so much of this as we did before the 21-ft. deepening work was undertaken, but there is actually more complaint of loss from striking bottom coming from the insurance offices than there used to be, so it will soon be in order to talk dams again, or something of the sort. If that movement should go through, where would the new zero mark go to? Who will say that it is more difficult to make a 2 ft. calculation that one involving 6 in., so long as one must always be made.

JOHN CHAMBERLIN.

DESCRIPTION OF THE KROONLAND.

Philadelphia, Feb. 12.—The steamship Kroonland, building at Cramps, Philadelphia, and to be launched Feb. 18, is justly regarded as the finest example of a passenger and freight liner ever turned out by a ship yard in the United States. She is a sister ship to the Finland, now well advanced by the same builders, and is similar beyond the arrangement of a few minor parts to the Vaderland and Zeeland contracted for by the International Navigation Co., at the yard of Messrs. John Brown & Co. Ltd., Clydebank, Glasgow. The keel of the Kroonland was laid during the summer of 1900 on the Cramps' recently acquired property situated to the south of the present plant, and since that time there has been no serious delay to the great work.

She is a twin-screw steamer with a length between perpendiculars of 560 ft., breadth 60 ft., depth 42 ft., and a gross tonnage of about 12,000. In all departments of construction this vessel is fully up to, and in many cases exceeds, the requirements of Lloyds and the British board of trade, as well as those of American law. There are eleven water-tight bulkheads, so arranged that flotation may be maintained with any two compartments full of water. Special attention has been given to the construction of these bulkheads, which are stiffened in accordance with the requirements of the bulkhead committee of the board of trade. If the Kroonland should be needed for service in time of war, the disposition of the bunkers would give coal protection to the boilers, while safety from breakdowns is practically assured by the adoption of twin-screws, which are fitted with enclosed shaftings and brought close together by the adoption of a small aperture in the stern frame.

Below the main deck, the hold and 'tween decks of the vessel are devoted to the carriage of cargo and stores, with the exception of a space amidships comfortably fitted for the firemen. This portion contains a promenade and is fitted with sheltered seats—a wise and thoughtful provision for their comfort. There is also a small space aft for the use of the stewards. There is a cubic capacity sufficient for some 11,000 tons of cargo, and tanks are provided for more than 200 tons of fresh water, in addition to what may be condensed en route. The storerooms are spacious and well arranged for the large quantities of provisions that will be carried. They include refrigerated chambers for meat and other perishable articles.

The main deck is given up to passenger accommodations. At the forward end are three compartments for third-class passengers, the men's quarters, and at the after part of this deck are the compartments for the married third-class passengers, who are berthed in staterooms containing two, four or six berths. These quarters have well lighted dining rooms. Every compartment has a wide companionway leading to the houses on the upper deck, which contain the lavatory and sanitary accommodations, also giving access to the promenades on that deck. On the upper deck, amidships, are staterooms for 106 first-class passengers. On this deck is also the first-class dining saloon, situated between the funnels, and extending the full breadth of the vessel. It can seat 208 passengers. The furniture is mahogany, except the sideboards which are of satinwood inlaid with various woods. For lighting and ventilation, in addition to the large and numerous side lights, there is an unusually large trunk-well extending through two tiers of decks and tastefully decorated in white, with a richly ornamented glass roof. The seats are covered with moquette and the upholstery throughout is in excellent keeping with the color scheme of the other decorative materials. Aft of this saloon, and between it and the second-class dining saloon, are situated the galleys, sculleries and pantries, so arranged that ready service can be given to either class of passengers and fitted with all the best and latest appliances. most of which are of American make. The second-class dining saloon comes next and also extends the full width of the ship. It can seat 120 passengers and is panelled with tapestry upon a soft cream white ground. The furniture is in mahogany and carpets, cushions and curtains are in varying shades of one color, giving a very pleasing effect. There are staterooms for 76 second-class passengers aft of this saloon.

Coming now to the upper deck and starting forward, there is a long forecastle fitted up for the accommodation of crew and petty officers with hospitals and lavatories for steerage passengers. Amidships is a bridge house 220 ft, long with staterooms for 204 first-class passengers at the fore end and 120 second-class at the after end These staterooms are large and excellently lighted and ventilated. In a deck house aft is the social room for third-class passengers. The deck above is the promenade deck which is sheltered by the permanent deck formed by the boat deck. Hereon are located the first-class library and smoking room as well as suites and special cabins. These rooms are in deck houses, lighted by Mullen's patent rectangular windows with ventilating stained glass panels in the upper part. The sanitary accommodiation for all classes of passengers is well arranged, and distributed rather than concentrated. There can be carried altogether 342 first-class, 194 second-class and about 1,000 third-class passengers. The navigation officers' cabins are placed above the promenade deck and at the fore-end of the boat deck; and above their deck-house is a spacious bridge, giving a clear view over the whole vessel and well sheltered by a strong steel bulwark.

There are altogether twenty boats, including four patent collapsible ones. The lifeboats are of steel, and are carried in the usual manner under davits. Each is fitted with patent disengaging gear. The arrangements for loading and discharging cargo are very complete. There are nine hatches, each having its own winch and derrick with the necessary fittings to ensure rapid handling. The upper deck hatches are fitted with dished steel covers instead of the usual wooden ones. The winches, windlasses and warping capstans are of American make. Docking and steering telegraph of Chadburn's make will be fitted and the steam steering gear is controlled by telemotor from the wheelhouse on the navigation bridge.

The ship is lighted throughout by electricity, the installation being fitted by the builders, as is also a complete system of electric bells. The generating plant is situated in a large room convenient of access from the engine room, and consists of four dynamos driven by engines of the Sturtevant company, of Boston, whose system of artificial ventilation will be installed in addition to the usual cowl ventilators above deck.

Charles E. White, Everett, Wash., will build a four-masted schooner 230 ft. long, with capacity to carry 1,400,000 ft. of lumber, for Capt. John Pederson.

SHIP BUILDING IN MAINE.

There is every prospect that the present year will be a very profitable one in ship building in Maine. At the yard of the New England Co., Bath, work will commence shortly upon three three-masted schooners. One is for Capt. McKown of Boothbay harbor, while the others are for C. A. Davis of Somerset, Mass., and Capt. Frank Benedict of New Haven, Conn. They will be about 500 tons burden and will measure 142 ft. on keel, 35 ft. beam and 13 ft. depth of hold. The contracts call for their completion the first of July. The firm has also begun putting on the top frames for the new steamer for the Kennebec and Boston line, to succeed the old Sagadahoc.

Percy & Small, Bath, Me., have the five-masted schooner Cora Cressey, which they are building for themselves, about planked, and the launching will take place early in the spring. The six-masted schooner which they are to build for J. S. Winslow & Co. of Portland, is about ready for framing, the keel having been stretched some time.

Gardiner G. Deering is getting out the frame for a large schooner, work upon which will be commenced early in the spring. Capt. Fremont Kimball, formerly of the schooner Annie F. Kimball, has placed a contract with Capt. James W. Hawley for building a four-masted schooner of these dimensions: Length, 160 ft.; breadth, 36 ft.; depth, 13 ft.; gross tonnage, 700.

Within a few weeks the Bath Iron Works will launch the beautiful steel yacht Pantooset from the ship shed, and immediately following this event work will be commenced upon the ways for the big steel barge contracted for the J. M. Guffey Coal Co. of Pittsburgh, Pa. Work upon the battleship Georgia is only in a primitive state at present. The monitor Nevada is fast nearing completion and will be ready for her speed trial early in the spring.

Arthur Sewall & Co., Bath, Me., are putting the finishing touches on the Atlas, built for the Standard Oil Co. of New York, and she will be ready for sea in about three weeks. Six hundred tons of sand is required for ballast for the Atlas. The Sewalls also have on hand a large oil-carrying barge for the Standard Oil Co., but the work is not very far advanced.

THE CARNEGIE INSTITUTION INCORPORATED.

The board of trustees of the Carnegie institution, having in charge Mr. Carnegie's gift for university extension work, has been incorporated. The gift is after all in bonds of the United States Steel Corporation, and very sensibly so, we think. The board of trustees elected by the incorporators to carry out the purposes of the institution, is as follows: Ex-officio—The president of the United States, the president of the United States senate, the speaker of the house of representatives, the secretary of the Smithsonian institute and the president of the national academy of sciences. Regular—Grover Cleveland. Abram S. Hewitt, New Jersey; Andrew D. White, John S. Billings, Elihu Root, Seth Low, New York; William N. Frew, Wayne McVeagh, Dr. S. Weir Mitchell, Pennsylvania; Lyman J. Gage, Charles L. Hutchinson, Illinois; Daniel C. Gilman, Maryland; Henry L. Higginson, Massachusetts; Henry Hitchcock, Missouri; William Lindsay, Kentucky; D. O. Mills, W. W. Morrow, California; John C. Spooner, Wisconsin; Edward D. White, Louisiana; Charles D. Walcott, Carroll D. Wright and John Hay. District of Columbia.

Mr. Carnegie, in expressing his appreciation of the high character of the trustees, spoke very feelingly. He also threw a side light upon the gift and showed how he had overcome the temptation to found an independent university upon the suggestion of George Washington. Mr. Carnegie said:

"Gentlemen—I beg to thank you deeply for so promptly, so cordially aiding me by acceptance of trusteeships. A note from the president congratulates me upon the high character, indeed I may say the extraordinary high character of the trustees—such are his words. I believe this estimate has been generally approved throughout the wide boundary of the United States. My first thought was to fulfill the express wish of Washington by establishing a university here, but a study of the question forced me to the conclusion that under present conditions, were Washington still with us, his finely balanced judgment would decide that in our generation at least, such use of wealth would not be the best. One of the most serious objections, and one which I could not overcome, was that another university might tend to weaken existing universities. My desire was to co-operate with all educational institutions and establish what would be a source of strength and not of weakness to them, and the idea of a Washington university, or of anything of a memorial character, was therefore abandoned.

"It cost some effort to push aside the tempting idea of a Washington university founded by Andrew Carnegie, which the president of the Woman's George Washington Memorial Association was kind enough to suggest. That may be reserved for another in the future, for the realization of Washington's desire would perhaps justify the linking of another name with his, but certainly nothing else would.

"This gift or the donor, has no pretensions to such honor, and in no wise interferes with the proposed university or with any memorial. It has its own more modest field, and is intended to co-operate with all kindred institutions, including the Washington university, if ever built, and it may be built if we continue to increase in population as heretofore for a generation. In this hope I think the name should be sacredly held in reserve. It is not a matter of one million, or ten millions, or even twenty millions, but of more, to fulfill worthily the wish of Washington, and I think no one would presume to use that almost sacred name except for a university of the very first rank established by national authority, as he desired. Be it our part in our day and generation to do what we can to extend the boundaries of human knowledge by utilizing existing institutions.

"Gentlemen, your work begins, your aims are high; you seek to extend known forces and to discover and utilize new forces for the benefit of man. Than this there can scarcely be greater work. I wish you abundant success, and venture to prophesy that through your efforts, in co-operation with those of kindred societies in our country, contributions to the advancement of the race through research will compare in the near future not unfavorably with those of any other land. Again, I thank you."

COMMERCE OF LAKE SUPERIOR.

AN EXHAUSTIVE AND INTERESTING REPORT DEALING WITH ALL PHASES OF THE LAKE CARRYING TRADE—THE ONLY GAUGE OF THE MIGHTY COMMERCE OF THE GREAT LAKES.

It has been hitherto explained in these columns that there is no measure of the port to port commerce of the great lakes, and therefore no way of determining the total commerce of the mighty chain of lakes. However, it is fair to assume that more than half the commerce of the lakes passes through the canals at Sault Ste. Marie and it is an extremely fortunate circumstance that these records are reliably kept by the officials in charge of the United States and Canadian canals. Gen. Supt. Joseph Ripley of Sault Ste. Marie canal has just submitted to Col. G. J. Lydecker for transmission to the secretary of war the exhaustive report of canal commerce for 1901, that is known as the mile-ton report. This report, compiled by Clerks Frank T. McArthur and John McMahon and Watchmen J. G. Wessel, G. S. Stanley, E. J. Riordan and W. H. Smith, after the close of navigation, goes into all manner of details regarding the canal traffic and it is, indeed, quite interesting. The report shows that $23,217,974.07 was paid as carrying charges to the vessels that moved 28,403,065 tons of freight through the canals in 1901, and that the total value of the freight was $289,906,865. The cost per ton per mile of moving this freight was ninety-nine hundredths of a mill against 1.18 mills for 1900 and 1.05 mills in 1899. The high rate for 1900 was, of course, influenced by the fact that the great bulk of the iron ore shipped during that year was carried at the contract rate of $1.25, made in the boom period preceding the opening of navigation.

The total freight traffic of 28,403,065 net tons is the maximum traffic in the history of the canals. It exceeds the traffic of 1900 by 2,759,992 tons, or 11 per cent. The total number of passengers was 59,663, an increase of 1,108, or 2 per cent. The season of navigation was open for a period of eight months and six days, during which time the average monthly traffic was 3,463,788 tons.

The American canal passed 25,582,038 freight tons, being an increase of 1,974,684 net tons over the year 1900, or 8 per cent.; the number of passengers was 29,701, a decrease of 6,612, or 18 per cent. as compared with 1900.

The Canadian canal passed 2,821,027 freight tons, being an increase of 785,308 net tons or 39 per cent. The number of passengers was 29,962, an increase of 7,720, or 35 per cent. as compared with 1900.

Of the total freight the American canal passed 90 per cent. and 50 per cent. of the total number of passengers; the Canadian canal 10 per cent. and 50 per cent. respectively.

The total vessel passages through both canals numbered 20,041 as against 19,452 for the year 1900, an increase of 589, or 3 per cent.; the total lockages numbered 11,321, which is an increase of 636, or 6 per cent.

The American canal was opened April 26 and closed Dec. 11, 1901; season, 230 days. The Canadian canal was opened April 20 and closed Dec. 21, 1901; season, 246 days.

While the traffic exceeds that of the preceding year by 11 per cent., yet this is less than the average annual percentage of increase; but the actual gain of 2,759,992 tons is the largest for any one year excepting that of 4,021,146 tons in 1899. The gain was made wholly after Sept. 1. The falling off in the early part of the season was due to the ice blockade in the St. Clair river and to the marine engineers' strike.

The increased tonnage was general for all the principal items of freight with the exception of soft coal, copper and building stone.

The depth of water in channels permitted a safe draught of 17½ to 19 ft. during the season.

Most of the 52 new vessels put in commission for the Lake Superior trade were large steam freighters, ranging from 375 to 450 ft. in length.

The growth of the Lake Superior commerce during the past half century has been phenomenal. The estimated amount and value of articles which crossed the portage at Sault Ste. Marie in 1851, to and from Lake Superior, was 12,600 net tons, worth $1,675,000. In 1861, a decade later, the traffic through the state locks was 88,000 tons, valued at $6,000,000; in 1871, 585,000 tons, estimated value, $13,000,000; in 1881, through the state and Weitzel locks, 1,567,741 tons at $30,000,000; in 1891, through the Weitzel lock, 8,888,759 tons at $128,178,208; in 1901, through Weitzel, Poe and Canadian locks, 28,403,065 tons at $289,906,865. Thus the average annual percentage of increase of each year's traffic over that of the preceding year has been as follows for the decades: 1851-61, 21 per cent.; 1861-71, 21 per cent.; 1871-81, 10¼ per cent.; 1881-91, 19 per cent.; 1891-1901, 12¼ per cent. Following are some of the most interesting conclusions:

Total mile-tons	23,383,861,987
Total freight carried, net tons	28,403,065
Total valuation placed on freight carried	$289,906,865
Average value per ton of freight carried	$10.21
Total amount paid for freight transportation	$23,217,974.07
Average distance freight was carried, miles	823.3
Cost per mile, per ton, mills	.99
Average cost per ton for freight transportation	$0.82
Total number registered vessels using canals	893
Total number passages by unregistered crafts carrying freight	413
Time American canal was operated, days	230
Time Canadian canal was operated, days	246
Total valuation placed on registered vessels	$60,556,100
Total number of passengers transported	59,663
Freight carried by—	
Registered vessels, tons	28,353,265
Unregistered vessels, tons	49,800
American vessels, per cent	96
Canadian vessels, per cent	4
Passengers carried by—	
American vessels, per cent	28
Canadian vessels, per cent	72

The number of registered vessels of 400 to 500 ft. in length using the canals in trade to and from Lake Superior was 71; of 300 to 400 ft. 152; of 200 to 300 ft. 303; of 100 to 200 ft. 282; and of less than 100 ft. in length 85.

The records show that 408 different vessels in a single trip of each carried a total of 1,696,360 net tons.

The maximum traffic for a single day was on Sept. 2, when 230,156 freight tons were passed by 150 vessels whose registered tonnage amounted to 202,525 tons. The minimum traffic for a single day was on April 24, when one ton of freight passed through the canals by nine vessels whose registered tonnage amounted to 1,092 tons.

The steamer Presque Isle, owned by the Cleveland Cliffs Iron Co., is credited with having moved the largest amount of freight through the canals during the season—161,375 net tons. This vessel also had the honor of moving the largest amount of freight during 1900 with a total of 195,550 tons to her credit during that year. The New York Central & Hudson River Railroad Co.'s steamer Buffalo has the greatest number of miles run to her credit—41,370. The greatest number of mile-tons—132,822,226—is credited to the Aetna Steamship Co.'s steamer J. J. Albright. The Pittsburgh Steamship Co.'s barge Manila carried the largest single cargo through the canal—8,288 net tons. The steamer William Edenborn, owned by the same company, carried 8,222 net tons.

Comparative statement of commerce through United States and Canadian canals at Sault Ste. Marie, Michigan and Ontario, for the seasons of 1900 and 1901:

ITEMS.	Traffic for 1901. United States Canal.	Traffic for 1901. Canadian Canal.	Total traffic for Season 1901.	Total traffic for Season 1900.	Increase, 1901. Amount.	Increase, 1901. Per cent.	Decrease, 1901. Amount.	Decrease, 1901. Per cent.
Vessel Passages:								
Steamers, number	10,934	3,438	14,372	14,426	.....	..	54	0
Sailing, number	4,146	336	4,482	4,004	478	12		
Unregistered, number	757	430	1,187	1,022	165	16		
Total, number	15,837	4,204	20,041	19,452	589	3		
Lockages, number	8,411	2,910	11,321	10,685	636	6		
Tonnage:								
Registered, net tons	22,222,334	2,404,642	24,626,976	22,315,834	2,311,142	10		
Freight, net tons	25,582,038	2,821,027	28,403,065	25,643,073	2,759,992	11		
Passengers, number	29,701	29,962	59,663	58,555	1,108	2		
Coal:								
Hard, net tons	730,441	74,052	804,493	515,515	288,978	56		
Soft, net tons	3,352,752	435,891	3,788,643	3,971,462	.....	..	182,819	5
Flour, barrels	6,432,064	1,202,286	7,634,350	6,760,688	873,662	13		
Wheat, bushels	43,217,104	9,595,532	52,812,636	40,489,302	12,323,334	30		
Grain, other than wheat, bushels	22,056,333	2,704,214	24,760,547	16,174,659	8,585,888	53		
Manufactured and pig iron, net tons	151,502	54,941	206,443	135,585	70,858	52		
Salt, barrels	389,889	53,885	443,774	328,895	114,879	35		
Copper, net tons	86,903	11,698	98,601	131,066	.....	..	32,465	25
Iron ore, net tons	16,493,916	1,596,702	18,090,618	16,443,568	1,647,050	10		
Lumber, M. ft. B. M.	1,060,880	11,244	1,072,124	909,651	162,473	18		
Silver ore, net tons	.....	.....	.....	110	.....	..		
Building stone, net tons	42,309	4,275	46,584	48,902	.....	..	2,318	5
Genl. merchandise, net tons	431,564	126,477	558,041	541,397	16,644	3		

American vessels carried 96 per cent. of the total freight and 28 per cent. of the total passengers. Canadian vessels carried 4 per cent. of the total freight and 72 per cent. of the total passengers. Unregistered American crafts carried 30,666 tons of freight in 232 passages, or an average of 132 362/2,000 tons per passage. Unregistered Canadian crafts carried 19,134 tons of freight in 181 passages, or an average of 105 425/2,000 tons per passage. Of the 20,041 passages for the season, 3,719 were by ninety-one vessels under 100 tons register, or an average of 37 tons each. The total freight carried by such craft amounted to 1,858 tons.

The following table will prove interesting as showing the distribution to other lakes of freight bound eastward from Lake Superior and also the districts from which freight bound to Lake Superior originated:

EAST BOUND.

From Lake Superior to—	Net tons.
Lake Michigan ports	2,211,476
Lake Huron ports	917,919
Lake Erie ports	19,716,465
Lake Ontario ports	241,882
Total	23,087,742

WEST BOUND.

From lower lake ports to Lake Superior—	
Lake Michigan ports	91,359
Lake Huron ports	187,517
Lake Erie ports	5,015,636
Lake Ontario ports	20,811
Total	5,315,323

Estimated value of freight passing St. Mary's Falls canal, Michigan, and Sault Ste. Marie canal, Ontario, for the season of 1901:

Items.	Quantity.	Price per unit.	Valuation.
Coal, anthracite, net tons	804,493	$ 5.60	$ 4,505,161
Coal, bituminous, net tons	3,788,643	2.90	10,987,065
Flour, barrels	7,634,350	3.25	24,811,637
Wheat, bushels	52,812,636	.69	36,440,719
Grain, other than wheat, bushels	24,760,547	.92	22,779,703
Manufactured iron, net tons	176,098	100.00	17,609,800
Pig iron, net tons	30,345	16.00	485,520
Salt, barrels	443,774	.75	332,830
Copper (refined and matte), net tons	98,601	266.00	26,227,866
Iron ore, net tons	18,090,618	3.25	58,794,509
Lumber, M. ft. B. M.	1,072,124	15.50	16,617,922
Silver ore, net tons	.....	.....	.....
Building stone, net tons	46,584	12.00	559,008
General merchandise, net tons	558,041	125.00	69,755,125
Total			$289,906,865

Average value per ton of freight for season of 1901, $10.21.
Average value per ton of freight for season of 1900, $10.41.

Amount paid for carrying freight that passed through United States canal at Sault Ste. Marie, Mich., and Canadian canal at Sault Ste. Marie, Ont., season of 1901:

Articles.	Quantity.	Rate per unit.	Amount.
Coal, net tons	4,593,136	$ .38	$1,745,391.68
Flour, barrels	7,634,350	.12	916,122.00
Wheat, bushels	52,812,636	.023	1,214,690.62
Grain, other than wheat, bushels	24,760,547	.022	544,732.03
Manufactured iron, net tons	176,098	2.00	352,196.00
Pig iron, net tons	30,345	1.50	45,517.50
Salt, barrels	443,774	.15	66,566.10
Copper, net tons	98,601	1.65	162,691.65
Iron ore, net tons	18,090,618	.78	14,110,682.04
Lumber, M. ft. B. M	1,072,124	2.55	2,733,916.20
Building stone, net tons	46,584	1.50	69,876.00
General merchandise, net tons	558,041	2.25	1,225,592.25
Total			$23,217,974.07

In connection with the foregoing table there is also the following summary of relative values of the different commodities passing through the canals:

	Per cent.
Iron ore, manufactured, and pig iron	26.6
Cereals—wheat, rye, oats, corn, barley, flax and flour	28.9
Copper	9.1
Lumber	5.7
Coal, anthracite and bituminous	5.3
All other products	24.4

Table showing total freight, its valuation, cost of transportation, average length of trips and rate per ton per mile for seasons indicated:

Year.	Total freight, net tons.	Valuation of freight.	Total cost of transportation.	Average distance freight was carried, miles.	Cost of transportation per mile-ton, mills.
1887	5,494,649	$79,031,757	$10,075,153.13	811.4	2.3
1888	6,411,423	82,156,019	7,883,077.40	806.4	1.5
1889	7,516,022	83,732,527	8,634,246.63	790.4	1.5
1890	9,041,213	102,214,948	9,472,214.90	797.2	1.3
1891	8,888,759	128,178,208	9,849,022.81	820.4	1.35
1892	11,214,333	135,117,267	12,072,850.88	822.4	1.31
1893	10,796,572	145,436,957	9,957,483.11	831.9	1.1
1894	13,195,860	143,114,502	10,798,310.28	821.1	.99
1895	15,062,580	159,575,129	14,238,758.02	830	1.14
1896	16,239,061	195,146,842	13,511,615.80	836.4	.99
1897	18,982,755	218,235,927	13,220,099.84	841.3	.83
1898	21,234,664	233,069,740	14,125,896.00	842.6	.79
1899	25,255,810	281,364,750	21,959,707.25	827.2	1.05
1900	25,643,073	267,041,959	24,953,314.71	825.9	1.18
1901	28,403,065	289,906,865	23,217,974.07	823.3	.99

The American canal records show that vessels necessarily spent 25,042 hours and 34 minutes in the canal, or an average of 1 hour, 34 minutes and 52 seconds, which includes time waiting for lockage and passage through locks and canal, the latter being 1 3/5 miles long. Other delays at canal, which included taking on supplies, waiting for daylight or favorable weather, amounted to 17,581 hours and 16 minutes.

The canal postoffice delivered 118,270 pieces of mail during the season, consisting of 107,643 letters, 4,926 postals, 5,046 newspapers and 655 parcels. In addition to this, 905 pieces were returned to the city postoffice, after being held 30 days uncalled for, and 2,441 pieces were forwarded to new addresses.

The following notes are made as to sources of information for traffic data and valuations:

Freight tonnage and passengers—The data relative to these items were compiled from reports made by vessel masters when passing through the American and Canadian canals, a daily exchange of these reports being made.

Registered tonnage and vessel valuations—The net registered tonnage is given and was obtained from vessel papers and blue books. Vessel valuations were obtained from Inland Lloyds.

Freight rates—These were compiled from quotations published in the Marine Review and from information obtained from shippers, owners and carriers engaged in handling the several classes of lake commerce. The freight rates are for transportation and include cost of loading and unloading.

Freight valuations—The unit value used for the various items of freight were derived by taking the mean for the season of each monthly average as obtained from daily or weekly prices current.

The sources of the valuations given are as follows: Coal, quotations in Coal Trade Journal at Duluth and Superior; cereals, Daily Commercial Record, published by Duluth board of trade; flour, daily quotations in Duluth, Superior and Minneapolis journals; iron ore and pig iron, weekly quotations in Iron Trade Review and Marine Review; salt, quotations at Lake Superior ports; copper, general merchandise, lumber, building stone and manufactured iron, quotations by the principal shippers, owners and carriers. To quotations given at point of shipment, freight rates are added to lake ports of destination.

CHICAGO NAUTICAL SCHOOL ALUMNI BANQUET.

The third annual banquet of the alumni of the Chicago Nautical School was held at the Leland hotel Feb. 6. Capt. Walter D. Hamilton was elected president; E. R Mason, vice-president; Thomas L. Page, secretary; and Capt. James Travis, treasurer. Steps were taken to form a permanent body by the adoption of a constitution and by-laws at another meeting to be held before the opening of navigation. Resolutions were adopted indorsing the position taking by the Shipmasters' and Masters and Pilots' associations on legislation pertaining to shipping now before congress. If the intention of forming an active body is carried out the alumni association is likely to be a strong and aggressive body, as the pupils of the school comprise many energetic men. Capt. Hamilton is to be congratulated on the way he is proposing to retain the pupils of the school in communication with each other.

AROUND THE GREAT LAKES.

Fred D. Wilkerson has been elected general manager of the Biwabik Mining Co.

The steamer Mary H. Boyce has been sold by Monroe, Boyce & Co. of Grand Haven to the Wanvig Transportation Co. for $35,000.

The affairs of the new Detroit & Buffalo line will be managed at the Detroit end by the Detroit & Cleveland line and at the Buffalo end by the Cleveland & Buffalo line.

Great preparations are being made for the Stevens mine on the Mesabi range. This mine promises to be one of the greatest on the range, ranking with the Mahoning and Mountain Iron mines.

Capt. James Davidson of Bay City Mich., has sold the schooner Crete to L. S. Sullivan, William C. Richards and Capt. Thomas Jones of Cleveland. She will tow behind the steamer Roumania during the coming season.

Capt. Patrick Sullivan, for thirty years a resident of Chicago, died on Sunday of Bright's disease. He was fifty-nine years old, and for the last ten years has been connected with the city water cribs, being in charge of the Carter Harrison crib at the time of his death. Previous to that time he sailed on the lakes.

Capt. N. P. Glazier died at his home in Cleveland this week in his ninetieth year. He was one of the oldest and best known of the lake captains. He was born in Vermont, Sept. 29, 1812. He was for many years captain of the old Bunker Hill of the Winslow fleet. During the civil war he served in the navy.

It was lately reported in the newspapers that President Greatsinger of the Brooklyn Rapid Transit Co. was to resign in order to devote his attention to his ore properties in Minnesota and Wisconsin. The report is untrue. Mr. Greatsinger has just been re-elected president of the company. He is well known in the lake region.

Senator Penrose has introduced a bill in the senate to found a naval station on the great lakes on the peninsula of Presque Isle at Erie. Secretary Long indorses the project in the following letter which accompanied the resolution: "Experience has shown that a large amount of good material is available in the cities of the great lakes for service in the navy, and the establishment of a training station in the vicinity referred to will, it is thought, induce the enlistment of a large number of men and thereby advance the interests of the navy. Some of those who have heretofore enlisted, however, have been found, after a few months training, to be wholly unsuited for seafaring life, thus necessitating their discharge. A weeding-out process at a training station would, therefore, be advantageous to the men and for the economy and best interests of the service. Naval training stations are now in successful operation at Yerba Buena island, San Francisco, California, and Newport, Rhode Island, and another is in process of establishment at Port Royal, South Carolina. The location of one on the great lakes, where, with the adjacent country, an excellent field exists for the enlistment of desirable men, would result in great benefit to the naval service." The bill appropriates $150,000 for the proposed training station.

A Duluth special says that the prospect at present are that there will be not to exceed 80 per cent. as much iron ore in stockpile at the mines of St. Louis county on May 1 as usual, but there will be more ore shipped this year than ever before in a single year. The reason for the estimated reduction of the winter output of 20 per cent. is probably guessed. The state board of equalization provided for the assessment of ore in stockpile as personal property, the same to be assessed May 1 at $1 a ton. Speaking of the present and prospective results of this, a well known mining man said: "The reduction of 20 per cent. in the aggregate winter output of the underground mines is an important loss to the ranges, and at a time of year when it is felt most acutely. Of course the 20 per cent. held back will show up and more with it before the end of the shipping season, but it will come at a time when there is plenty of work for everybody. In winter it is different. Then it is that the greatest activity in the mines is desired in order that as many men as possible may be employed. It would be a great help to the range towns if the mines were free to work as heavy in winter as their operators would like. The owners of underground mines are standing for a real estate tax on their mining property and for a personal property tax on their ore in stockpile. The open pit mines, which have no stockpiles, are taxed as real estate and that is the end of it. It is likely that ore shipping to the docks will begin as early as possible in the spring. Such ore as is moved from the stockpiles before May 1 will escape the personal tax assessment, but the ore that will be thus moved will not be a very big item, and the companies may not move any for the purpose of escaping the tax."

During the past few days six properties on the Mesabi range have been transferred. The Eastern Minnesota railway, P. L. Kimberly and the Youngstown Iron, Sheet & Tube Co. of Youngstown, O., are the purchasers. The Youngstown company has purchased the lease of sixty acres in 11-57-21, south of the Mahoning mine, known as the Jones property. The parties interested in this lease were J. T. and T. J. Jones, Capt. W. H. Cole, A. L. Agatin, John G. Williams of Duluth; A. R. Coates and Dr. Stuart Bates of Virginia. The area of the tract is eighty acres. The Youngstown concern has also acquired leases to two of the Maitland properties, one in 32-57-20 and the other in 5-57-17, the latter a forty situated a short distance south of the Fayal mine, near Eveleth. The leases to both properties were owned by former State Senator A. Maitland of Negaunee, manager in the Lake Superior region for the Republic Iron & Steel Co. The properties acquired by the Eastern Minnesota are situated in 12-57-21, one in the northeast quarter of the northeast quarter, and the other described as the north half of the northwest quarter of that section. Among those interested in these two leases were J. L. Washburn, Capt. W. H. Cole and M. H. Alworth. The amount of the bonus in each of the deals aggregated $500,000, and the extent of the ore proved up on them is about 15,000,000 tons. The two Eastern Minnesota leases brought $225,000. It is claimed that the Eastern Minnesota now controls lands of known or prospective iron ore value to the extent of more than 100,000 acres. Mr. P. L. Kimberly of Sharon, Pa., is reported to have bought the lease in 12-57-21 controlled by Messrs. Hale, Morrow, Palmer, Michand and Williams of Duluth. A large deposit of ore has been discovered on this land.

THE SCIENCE OF STORMS.

BY WILLIS L. MOORE, CHIEF OF THE UNITED STATES WEATHER BUREAU.*

At about 100 miles from the surface of the earth there is only the hypothetical ether which, while too tenuous to be detected or measured by any appliance known to man, is supposed to transmit the solar vibrant energy. This energy, coming in many different wave lengths, and with widely differing velocities of vibration, produces a multitude of phenomena as it is absorbed or passes through our air, or as it impinges upon the surface of the earth. The longer and slower waves are convertible into heat, the shorter and more rapid ones into light, and the minutest movements, probably into electricity. The air, even at the surface of the earth, is not dense enough to absorb and convert into heat much of this solar energy, and therefore the earth receives it, is itself warmed on the surface and in turn radiates back into the air, in such condition of wave-length and velocity of vibration that the air can absorb it, most of the heat that the air receives. The atmosphere is thus warmed from the bottom upwards. This accounts for the perpetual freezing temperatures of very high mountain peaks, although they are nearer the sun than are the bases from which they rise. At the height of 100 miles the temperature must be about that of outside space, probably 459 degrees Fahrenheit below zero.

Air liquefies at 312 degrees below zero, and, therefore, it cannot exist in the gaseous state in a region having a lower temperature. When it is liquefied it has the color and general appearance of water, and about the same specific gravity. When a piece of steel and a lighted taper are brought together inside of a vessel filled with liquid air the dense supply of oxygen makes combustion so rapid that the hard metal burns like tinder.

At the height of 50 miles there is enough air to slightly refract light at twilight and to render luminous the meteors that rush with fearful velocity against the widely scattered molecules. But at this distance from the earth there probably is no more air than would be found under the receiver of the best of air pumps.

At the height of about 25 miles the air, light as it is, has still sufficient density to obstruct the passage of the minutest wave-lengths of light. Here may be developed the electro-magnetic energy which, in extreme northern and southern latitudes, is manifested in the auroras. Here also begins to be appreciable the blue tint of the heavenly vault.

At the height of 10 miles the temperature is unchangeable from winter to summer, and not less than 60 degrees below zero. At this short distance from the earth there is a death-like stillness, for there is no medium sufficiently dense to transmit sound. Two persons could not hear each other speak, even if they could live in this rare atmosphere, which they could not. Here is eternal peace and no apparent motion, for storms and ascending and descending currents cease long before they reach this level.

At the height of 6 miles the cirrus clouds common to this level are, on account of the low temperature, always composed of minute ice spiculæ—never of watery droplets—and in the middle latitude of both hemispheres the air at this height is ceaselessly rushing toward the east, passing uninterruptedly over the cyclonic and anti-cyclonic systems that constitute our storms and cold waves at the surface of the earth. Glaisher ascended to this height, but he became insensible by asphyxiation, and his assistant retained consciousness only by breathing liberated oxygen. They were nearly destroyed by the cold which registered many degrees below zero, although the time of year was Sept. 5.

The dry air at the surface of the earth is a very poor conductor of electricity, but the same air reduced to the low density found at the six-mile level is a wonderfully good conductor. It is this condition of the upper air that Tesla claims he may be able to take advantage of in transmitting electric power to a great distance without the use of a metallic medium.

Air is so elastic and its density decreases so rapidly as it recedes from the earth that nearly one-half of the entire mass of air lies below the level of the top of Pike's peak, which has a height of little less than 3 miles above sea level.

At the height of 1 mile the temperature is about the same at midday as at midnight.

Only during very recent years have we begun to realize how extremely thin is the stratum of air next to the earth that has sufficient heat and moisture for the inception, growth and maturity of animal and vegetable life. The raising of the instrument shelter of the New York city observatory from an elevation of 150 ft. above the street to an elevation of 300 ft. has caused an apparent lowering of the mean annual temperature of 2½ degrees.

On the hottest days in summer if one could be lifted up to a height of 1,000 ft. in free air he would find a temperature so cool as to be pleasant and conducive to bodily vigor.

Any intelligent person, by studying the few simple principles on which the daily weather map is founded, can make an intelligent estimate of the general character of the weather, for his region one, two, and, at times, three days in advance.

You may ask: Why has not this been done by the laymen whose crops, whose perishable produce in transit, whose vessels exposed to the fury of wave and tempest, and whose health and pleasure are so dependent upon the weather and upon the sequence in which weather changes occur? In answer it may be said that many members of commercial associations, knowing the fluctuations in value of soil products that often result when rain falls on a parched district, when frost smites the corn in the milk, when hot south winds wither the crops in the great central valleys, or when clouds and moisture affect the condition of cotton, make a fairly accurate forecast of the weather from the large daily weather maps displayed on blackboards before all the important commercial exchanges of the country, and in a pecuniary way largely profit therefrom.

This morning at 8 o'clock Washington time (which, by the way, is about 7 o'clock in Chicago, 6 o'clock at Denver, and 5 o'clock at San Francisco) the observers at 200 stations in the United States and contiguous territory were taking their observations, and from carefully tested and standardized instruments noting all the elementary conditions of the air at the bottom of the great aerial ocean in which we live.

By 8:20 a. m. the barometers have been reduced to sea level, so that inequalities due to local altitudes may not mask and obscure those due to storm conditions, the necessary mathematical corrections made, the observations reduced to cipher form, and each report has been filed at the local telegraph office. During the next forty minutes the observations, with the right of way over all lines, are speeding to their destinations, each station contributing its own observation and receiving in return, by the workings of an ingenious system of telegraph circuits, such observations from other stations as it may require. The observations from all stations are received at such centers as Washington, Chicago, New York, and other large cities, and nearly all cities having a weather bureau station receive a sufficient number of reports from other cities to justify the issuing of a weather map.

Now picture in your mind that all the air inside the isobar marked 30.2, as it moves inward, is rotating about the "low" in a direction contrary to the movement of the hands of a watch, and you have a very fair conception of an immense atmospheric eddy.

Have you ever watched the placid waters of a deep running brook and observed that where it encountered a projecting crag little eddies formed and went spinning down the stream? Well, our storms are simply great eddies in the air that are carried along by the general easterly movement of the atmosphere in the middle latitudes of the northern hemisphere. But they are not deep eddies, as was once supposed. The "low" marks the center of an atmospheric eddy of vast horizontal extent as compared with its thickness or extension in a vertical direction; thus a storm condition extends from Washington to Denver in a horizontal direction and yet extends upwards but 4 or 5 miles. The whole disk of whirling air 4 or 5 miles thick and 2,000 miles in diameter is called a cyclone, or cyclonic system, or a low-pressure area. It is important that a proper conception of this fundamental idea be had, since the weather sequences, experienced from day to day, depend almost wholly upon the movement of these traveling eddies, cyclones, or areas of low pressure.

The foregoing are a few of the generalizations of which the forecaster takes cognizance and that guide him in his deductions. In brief, he carefully notes the developments and movements in the air conditions during the preceding twenty-four hours, and from the knowledge thus gained makes an empirical estimate of what the weather will be in the different sections of the country the following day.

By preserving the weather charts each day and noting the movements of the highs and the lows, any intelligent person can make a fairly accurate forecast for himself, always remembering that the lows, as they drift toward him from the west, will bring warmer weather and sometimes rain or snow, and that as they pass his place of observation the highs following in the tracks of the lows will bring cooler and probably fair weather.

He can closely forecast the temperature for his region by remembering that the weather will be cool so long as the center of the predominating high, i. e., the high inclosing the greatest area within the 30-in. isobar, is north of his latitude—either northeast or northwest, and that it will be warm so long as the high is south of his latitude.

West Indian hurricanes are cyclonic in character, but on account of the fact that the diameter of the whirling eddy is much less and the velocity of rotation much greater than in the average cyclone that crosses our continent, it is customary to designate them as hurricanes. In other words, the hurricane is a cyclone of small area but powerful vortical action, and consequently of great destructive force. To get a rough idea of the difference between storms, we might classify them according to the diameter of the gyrating masses of air under their influence, as follows:

Cyclones, 1,000 to 2,000 miles; hurricanes, 100 to 500 miles; and tornadoes 100 to 1,000 ft. We might imagine their vortical action and their destructive force to increase in some ratio as their diameters of rotation decrease.

The tornado is always an incident and a sporadic outbreak of the cyclone and usually occurs in the southeast quadrant of a cyclonic storm.

The thunderstorm, instead of rotating about a vertical axis, like the cyclone and tornado, has a horizontal roll, caused by cold and heavy air from above breaking through into a lighter and super-heated stratum next to the earth. This rolling motion throws forward the cool air in the direction in which the cloud is moving. In general, thunderstorms move from the west toward some eastern point, the same as tornadoes, which mostly move from the southwest toward the northeast. If any part of the horizontally-rolling air in the thunderstorm drops down toward the earth and adjusts its rotation about a vertical axis it at once becomes a tornado, and its destructive force is increased a hundred fold. Thunderstorms are seldom more than 5 or 10 miles in width, and their tracks are not often more than 20 or 30 miles in length. There is a close relation between the conditions of air that produce thunderstorms and those that produce tornadoes.

The staff of the weather bureau, which includes many able meteorologists, has not failed to make a study of the peculiarities of the several types of storms occurring in different localities during the various seasons of the year, their lines of travel, and the force they may be expected to attain. The comparative merits of those who, by education and natural ability, were the best fitted to correctly and quickly correlate in their minds the conditions shown on a meteorological chart and to make accurate deductions therefrom as to the development, movement and force of storms, have been tested by competitive examinations.

This line of study and competition has resulted in improved forecasts, so that mariners now universally heed the storm warnings, horticulturists make ample provisions against frost, and shippers of perishable produce give full credence to the cold wave predictions. Of the many West Indian hurricanes that have swept our Gulf and Atlantic seaboard during recent years, not one has reached a single seaport without danger warnings having been sent well in advance of the storm, and few unnecessary warnings have been issued. The result is that few disasters of consequence have occurred.

Large owners of marine property estimate that one severe storm traversing our Atlantic coast in the absence of danger warnings would leave not less than $3,000,000 worth of wreckage. On two occasions a census was taken immediately after the passage of severe hurricanes to de-

*An address before the Manufacturers' Club of Philadelphia.

termine the value of property held in port by the danger warnings sent out in advance of the storms. In one case the figure was placed at $34,000,000, in the other at $38,000,000. Of course this does not represent the value of property saved. It simply shows the value of property placed in positions of safety as a result of the danger signals displayed and the warning messages sent to vessel masters.

On Jan. 1, 1898, an extensive cold wave swept from the Rocky Mountains eastward to the seaboard. Estimates secured from shippers in 100 principal cities indicated that property valued at $3,400,000 was saved as a direct result of the predictions sent out.

There is hardly a daily paper that does not publish the weather forecasts in a prominent place, and there is scarcely a reader who fails to note the predictions. The utility of these forecasts to the agriculture, the commerce and other industries of the country is unquestionably great.

Some idea of the vast interests floating in Atlantic ports may be had when it is stated that 5,628 sailing craft, aggregating 2,105,688 tons, enter and leave ports on the Atlantic seaboard during a single year. The value of their cargoes is more than $1,500,000,000. Our coastwise traffic also is enormous. In one year more than 17,000 sailing vessels and 4,000 steamers enter and leave ports between Maine and Florida. Their cargoes are estimated to be worth $7,000,000. From these facts one may roughly measure the value of the marine property which the United States department of agriculture, through the work of the weather bureau, aims to protect by giving warnings of approaching storms.

BRITISH COMMERCE FOR 1901.

The statistics of British commerce for 1901 are of more than ordinary interest, for they present unmistakable symptoms of disturbance in the current of trade which is more likely to increase in the near future than to subside. The causes are twofold, and fundamental in their character. One is the progressive decadence of British agriculture, and the other the diminishing coal deposits. A third, not less important, though not in the same way, is the decreased ability to pay for the food imports, especially those from this country, out of the dividends accruing from the once large holdings of foreign bonds and stocks. To the British people the food question is the vital one, and as the land of the United Kingdom continues to go out of cultivation, it is becoming a source of ever-growing anxiety to both government and people. The import of cereals alone last year was 850,000 tons in excess of the quantity brought in during 1897; of this wheat figured for 250,000 tons. The following table, in which the various articles of import and export are put into particular classes for brevity's sake, presents a general view of the situation. The comparison is with the previous year, 1900:

IMPORTS.

Articles classed.	1901.	Increase from 1900.	Decrease from 1900.
Live stock	$ 47,000,165	.....	$ 1,111,430
Food stuffs, free	814,748,330	$34,297,890	.....
Food stuffs, dutiable	237,977,505	.....	8,175,140
Tobacco, dutiable	24,097,365	100,280	.....
Metals	153,937,260	.....	12,039,695
Chemicals, dye stuffs, etc.	30,647,795	2,843,830	.....
Oils	55,153,030	.....	13,570
Raw materials (texile)	397,008,860	10,272,045	.....
Raw materials for sundry industries.	289,772,550	.....	35,625,905
Manufactured articles	468,048,770	1,923,745	.....
Miscellaneous	86,490,990	2,632,885	.....
Parcel Post	6,312,310	714,180	.....
Total merchandise	$2,611,194,930	$52,784,855	$56,965,740
Difference	.....	.....	4,180,885
Gold	103,578,140	.....	27,376,225
Silver	57,508,390	.....	9,103,110
Grand total	$2,772,281,460	.....	$40,660,220

As will be seen, the imports of food stuffs of all kinds, including drink, showed a notable increase; as also did raw material for textile industries. Of this last item the bulk of the increase was in cotton; flax, hemp and jute also contributing. Silk, however, declined in a remarkable manner, being just about half the quantity imported in 1899. In other raw materials there was considerable decrease, particularly in iron ores. On the other hand manufactured articles exhibited an increase, principally in glass, hardware and partially manufactured iron and steel. Imports of woolen goods also were heavier than in 1900.

The table of exports shows a remarkable falling off in the value as compared with 1900:

EXPORTS.

Articles classed.	1901.	Increase from 1900.	Decrease from 1900.
Live stock	$ 3,712,495	.....	$ 796,720
Food stuffs	74,424,575	$ 6,315,800	.....
Raw materials	166,888,220	.....	42,506,825
Manufactured and partly manufactured yarns and textiles	517,357,805	6,295,805	.....
Metals and their manufactures except ships and machinery	197,068,810	.....	29,665,735
Machinery and mill work	89,276,675	.....	8,822,245
Ships (new)	45,799,380	2,860,830	.....
Apparel, etc.	54,700,300	2,729,300	.....
Chemicals and their preparations	44,710,545	.....	1,602,050
Other manufactures or partly manufactured	190,343,795	8,273,460	.....
Parcel Post	18,211,845	3,452,845	.....
Total value British exports	$1,402,494,445		
Foreign and colonial merchandise	339,234,215	23,325,425	.....
Gold	69,826,325	.....	22,160,970
Silver	60,249,185	.....	7,623,715
Grand total	$1,871,804,170	$53,253,465	$113,178,260
Difference	.....	.....	59,824,795
Excess imports over exports	$900,477,280	$19,264,575	.....

The falling off in British exports of $59,924,795 in 1901 compared with the previous year is a noteworthy fact. It was due almost entirely to the changed position of the coal trade, which declined to the extent of $41,415,000 in value and 2,332,000 tons in quantity. This is made evident by the decreased export in raw materials shown in the table above. The increased export of cotton goods was chiefly to India and due in great part to the stimulating effect of the condition of the exchange between Great Britain and India; also to a small extent to China, Egypt, Turkey, Greece and Central America. There was a considerable falling off to this country, Canada, Australia, Japan and the foreign West African settlements; and the decline in jute, linen and silk goods was more or less serious. In woolens, except yarns, the trade was unsatisfactory. So were the exports of pig iron and of bar, angle and other small iron wares; and though there was a moderate increase of railway iron, it was chiefly due to the stimulus of colonial and Indian public works loans raised in the London market. The total exports of iron and steel of all descriptions fell to 2,900,000 tons, which was 344,000 below the total for the worst of any of the preceding four years, and 800,000 below the highest figure, which was in 1899. The value of steam engines, locomotives, sewing machines and other minor articles showed a slight increase over 1900; but on the whole the metal trade in all branches was unsatisfactory, and the general drift of the trade of Great Britain inclines to the belief that it has entered on a period of retrogression, with the resources of the country diminished by the drain of the war in South Africa. That this is the case is shown by the report of the board of trade labor department, according to which, for the first time since 1895, the first half of 1901 showed a net diminution in the wages distributed among English workmen of $150,000 per week. This was increased during the second half of the year just closed, with a decided tendency to a still further diminution of the wage bill.

ENGLISH SHIP BUILDING FIRMS COMBINE.

A circular has been issued to the shareholders of Vickers, Sons & Maxim, Ltd., informing them that a provisional agreement has been made to acquire one-half of the ordinary shares in William Beardmore & Co., Ltd., which company has been formed to take over the business carried on by Mr. Beardmore at Parkhead Forge, Glasgow; Napier Yard, Govan; and Dalmuir Ship Yard, Dumbartonshire, ship builders and manufacturers of armor plates, railway material, ship plates, and forgings. It is stated that at the present time the ship yard is fully occupied with the construction of vessels for the admiralty and mercantile marine, and Mr. Beardmore has recently acquired a site at Dalmuir for a new ship yard, which will have a greatly increased output, and will be equipped with the most modern plant and appliances for economically building and completely engining vessels of all types and dimensions. The directors have come to the conclusion that it would be of advantage to the company that the two firms should have a community of interests, and a provisional agreement has been made whereby, in consideration of the issue, as fully paid, to Mr. Beardmore of 362,500 ordinary shares of Vickers, Sons & Maxim, Ltd., and of the further number of ordinary shares not exceeding, in any event, 37,500 (when certain outstanding matters have been adjusted), Messrs. Vickers acquire one-half of the ordinary share capital of William Beardmore & Co., Ltd., which will be entitled to rank for dividends from the date of the registration of the company. The shares of Vickers, Sons & Maxim, Ltd., issued to Mr. Beardmore will not rank for dividend in respect of the profits of the year 1901. The business of William Beardmore & Co. has shown an average profit during the five and one-half years ending June 30, 1901, of over £140,000 per annum, while in the year 1900 the profits exceeded £200,000. In order to carry out this arrangement, Mr. Beardmore's business has been registered under the limited liability companies acts, with an ordinary share capital of £1,500,000, and it is contemplated to create and issue preference shares when further capital is required. The Vickers company will be represented on the board of William Beardmore & Co., Ltd., by two of their directors, Mr. Albert Vickers and Lieut. A. T. Dawson. Mr. Beardmore will be the chairman and managing director of William Beardmore & Co., Ltd., and his brother, Mr. Joseph Beardmore, will likewise join that board. Mr. Beardmore will be appointed a director of Vickers, Sons & Maxim, Ltd., and has engaged to hold, for the period of twelve months, all the ordinary shares of this company allotted to him, and not to reduce his holding in any subsequent year by more than 50,000 shares.

INCREASE IN SIZE OF BRITISH SHIPS

Sir John Glover, chairman of the Lloyd's Register committee, has estimated the increase by decades for half a century past, in number and size of British cargo ships. The comparison is exceedingly interesting, in view of the present situation of ocean freight rates. It shows that, although the number of vessels registered has decreased steadily since 1860, their net tonnage has steadily increased, and that the new tonnage floated since 1890 is fully up to the best average of any decade. Rate of increase in tonnage was 30¾ per cent. in the ten years ending 1860, 22⅛ per cent. in the 1870 decade, 15½ per cent. in that ending 1880, 20¾ per cent. in the decade terminating in 1890, and 16¾ in the past decade.

Sir John Glover's detailed figures are as follows:

Year.	Number on register.	Net tonnage.
1900	19,751	9,280,164
1890	21,233	7,945,071
1880	25,185	6,574,513
1870	26,367	5,690,789
1860	27,663	4,658,687
1850	25,984	3,564,833

The French submarine Espadon, which is of the Narval type, has returned to Cherbourg after undergoing a twenty-four hours' trial in the open sea. Notwithstanding the heavy sea, which made navigation difficult, the vessel is said to have successfully accomplished the journey to Havre and back, attaining an average speed of 8 knots an hour. Before entering the harbor she discharged four torpedoes at a target, which was struck.

The statistics relating to the traffic through the Suez canal last year testify to fair progress when compared with the year 1900. The figures are: 3,699 vessels in 1901, against 3,441 in 1900; and the receipts were 100,363,821 francs, against 90,623,609 francs.

WRECK OF THE PEWABIC RECALLED.

Iron Ore of Ishpeming, Mich., in its last issue contained the following article:

"The Marquette Mining Journal has been publishing the recollections of some of those who lived here in the early days, and there seems to be some question as to the year the steamer Pewabic was lost. Mr. Alfred Meads thinks she went down in 1863, while Capt. Mitchell thinks it was 1865 she was sunk. Capt. John Waters of Ishpeming has a distinct recollection of the time. He, in company with Capt. Dick Hodge, left Houghton in the fall of 1864, in the Pewabic, for Ontonagon. They secured employment in the Ridge mine, now the Mass, and in three days earned $80. One seldom forgets the time of such a good thing. He remained in the Ontonagon district until February, 1865, when he went to Houghton by sleigh, having a very rough ride. It was the same year, 1865, that the Pewabic was lost. There was a heavy fog at the time and the Pewabic was cut in two by the steamer Meteor, sinking immediately. The wife of Capt. Pascoe of Ishpeming was on the Meteor at the time of the accident. She landed in Ontonagon on Aug. 12, 1865, a few days after the accident occurred. The Meteor was somewhat damaged by the collision and had put into port for repairs, reaching Ontonagon a few days afterward. Mrs. Pascoe's name was Hodge at that time, she being then unmarried. So Capt. Waters thinks he has the time of the accident located within a few days."

The Pewabic was sunk in collision with the Meteor in Thunder bay on Aug. 8, 1865. The accident occurred at 8 o'clock in the evening. While it had been a hazy, rainy day, the evening was sufficiently clear to distinguish objects at a considerable distance. Both the Pewabic and Meteor saw each other for half an hour before the accident occurred. Capt. George P. McKay was the master of the Pewabic, but after supper he had gone down to the engine room to speak to the engineer, not apprehending danger in any form whatever. The Pewabic altered her course twice to avoid the Meteor, but, however, without whistling, and Capt. McKay was summoned on deck just as the vessels were about to collide. He had barely time to give an order when the Meteor struck the Pewabic and she sank within a few minutes. The Meteor came alongside upon Capt. McKay's order and took off as many passengers as she could. Several were picked up by small boats later, but a number were lost. The Pewabic was launched in October, 1863, so that her life was brief.

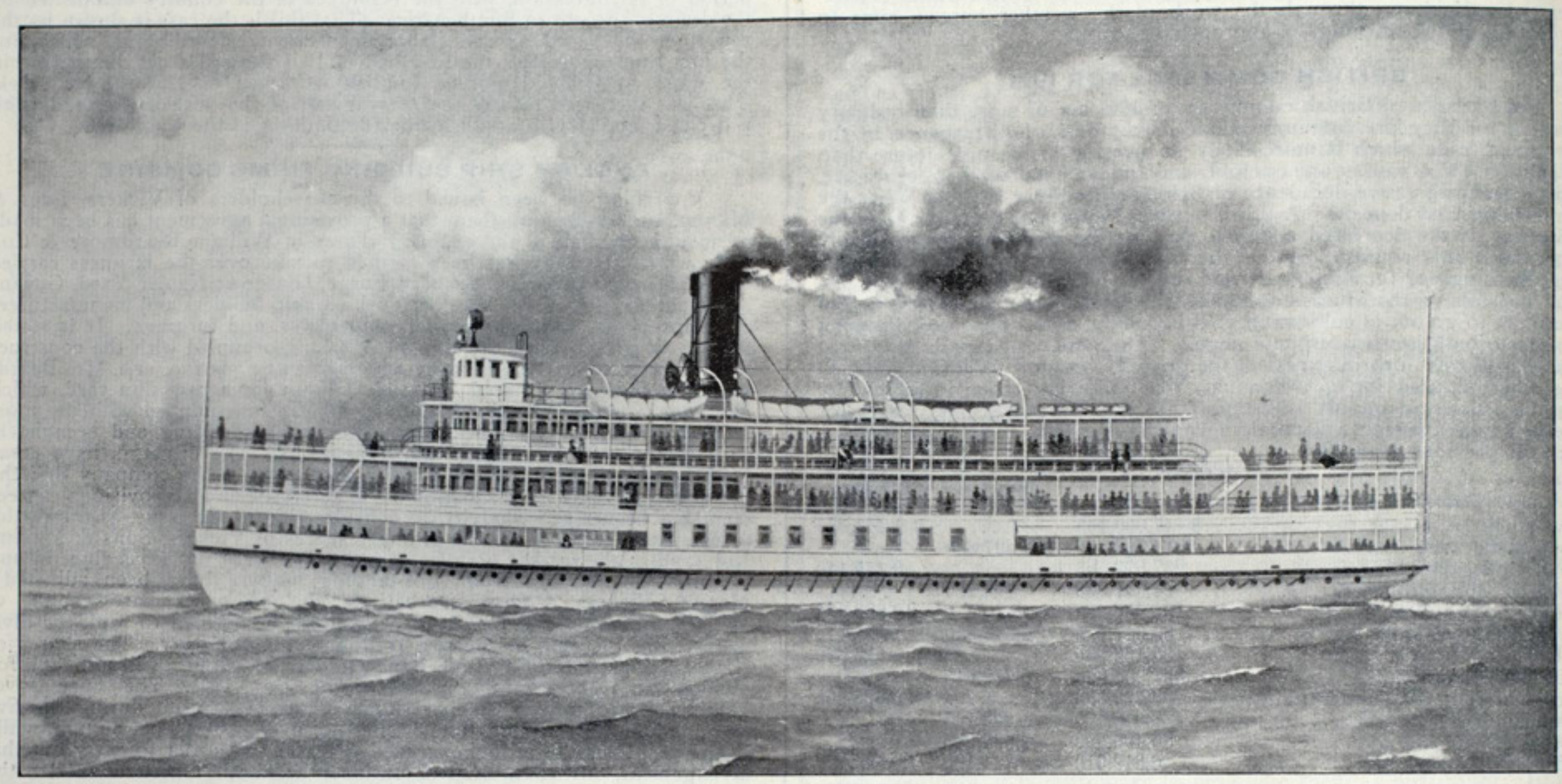
PITTSBURGH COAL CO.'S STATEMENT.

Mr. Francis L. Robbins, president and chairman of the executive committee of the Pittsburgh Coal Co., has submitted his annual report showing that the profits of the company for the year ended Dec. 31, 1901, were $4,272,209.26 after deducting all expenses. The assets of the company are $76,276,728.69. The coal acreage, surface plants and mine plants are valued at $62,709,975.77 and the docks at the different lake ports are put in at $2,937,829.11. During the past year the company purchased 23,195 acres of coal land and 1,620 acres of surface land in the vicinity of Pittsburgh and the property of the Shaw Coal Co. in the same district was leased for a term of forty years. The company purchased and leased a number of docks at lake ports during the past year. Among the docks thus secured and under contract are the following: Pioneer Fuel Co.'s docks at Duluth and Gladstone; Ohio Coal Co. docks at Duluth and Milwaukee; the C. Reiss Coal Co. docks at Sheboygan, Ashland, Manitowoc and Escanaba, and the docks of the Whitnell Coal Co. at Milwaukee.

The expenditures on this account thus far are $632,915. The properties representing this investment show from their operation during the year ended Dec. 31, 1901, net earnings of at least 15 per cent. on the amount of its investment. In connection with these docks the company acquires a large anthracite and Hocking valley coal business. The company is now in control and owns approximately 5,000 acres of coal lands in the Hocking valley, formerly property of the New Pittsburgh Coal Co. and the Greendale Coal Mining Co. This property, among other things, consists of eight mines, having a capacity of 2,000,000 tons per annum, and was taken over by the company by the purchase of the capital stocks of the above named companies with the property free and clear from debt.

A NEW EXCURSION BOAT.

The excursion steamer which the Detroit Ship Building Co. is building for the Detroit, Belle Isle & Windsor Ferry Co. will be one of the best in her special line on the great lakes. She is designed exclusively for the accommodation of the large excursion parties which visit Bois Blanc park at the head of Lake Erie every summer. The new steamer is to be completed so as to be in readiness for the opening of the Bois Blanc park season on June 9. She will be a three-decker, and will be fitted with spacious cabins for the accommodation of ladies and children. Her dimensions are: Length over all, 216 ft.; breadth of hull, 45 ft.; breadth over guards, 60 ft.; depth, 17 ft. 9 in. Drawing 12½ ft. of water, she is expected to maintain a speed of 16 miles an hour or better. The steamer will be fitted with two cylindrical boilers of the return-tube type, each 12 ft. long and 13 ft. 2 in. in diameter, and tested for 180 lbs. steam pressure. Her engines are to be of the triple-expansion type, with cylinders 21½x34x54 in., having a 36-in. stroke. The new steamer will land at and leave the dock at the foot of Bates street, where the ferry company is now erecting a magnificent new pavilion and waiting room, which will be completed for use at the opening of the season.



THE NEW EXCURSION STEAMER OF THE DETROIT, BELLE ISLE & WINDSOR FERRY CO.

STEEL SHIP BUILDING IN CANADA.

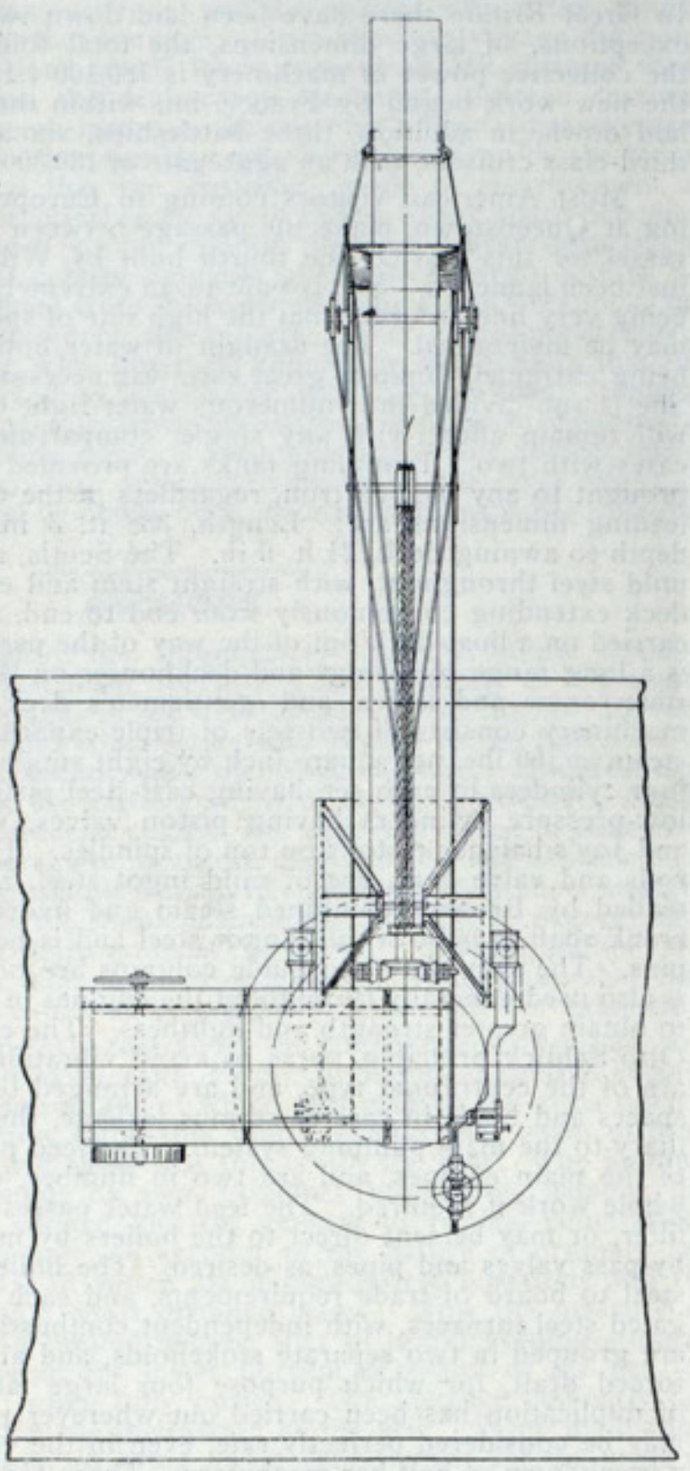
Mr. G. B. Hunter of Swan, Hunter & Co., Newcastle-on-Tyne, has finished his investigation for the present into the subject of a steel ship building industry in Canada. He visited several points in the Dominion and prior to his departure for England said in Montreal:

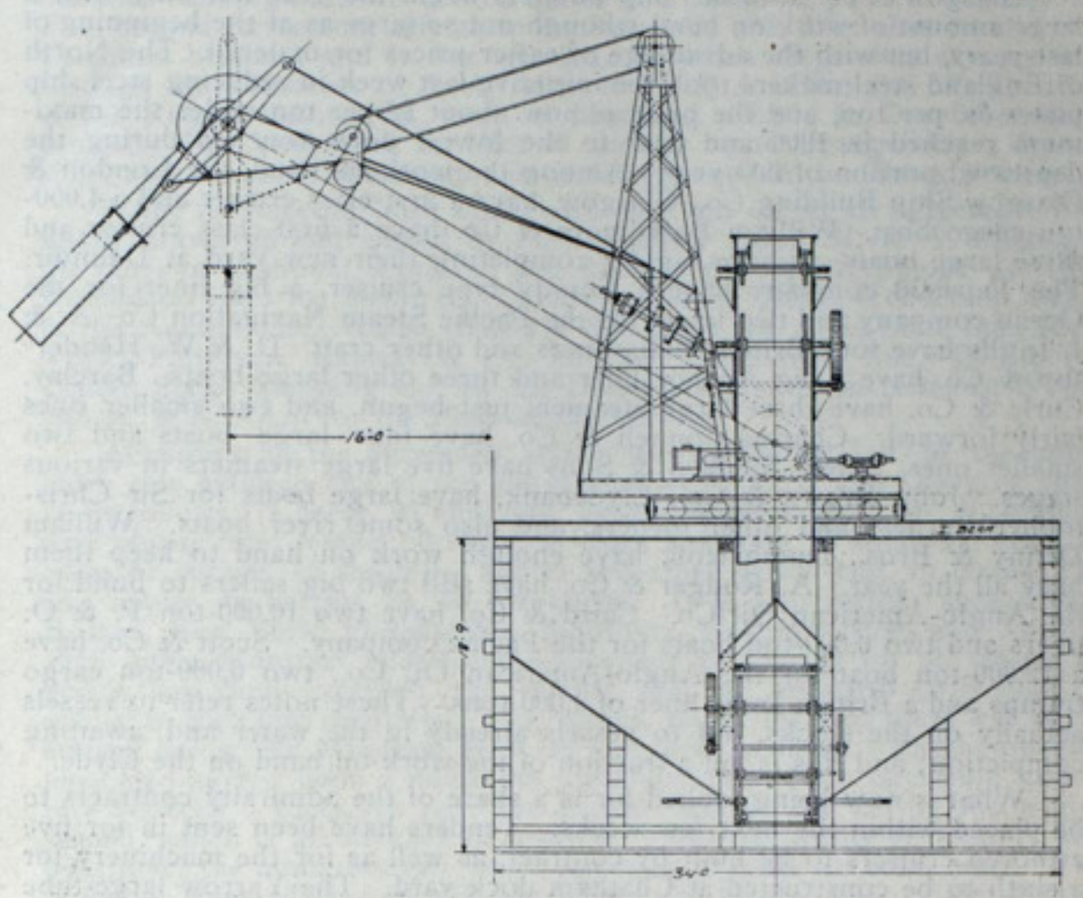
"I see a great future for the steel ship building industry in Canada. From the nature of things, steel ship building can be done in Canada cheaper than anywhere else in the world. No country will in the future compete with Canada—neither England nor Germany nor the United States. At present, however, the steel necessary for the construction of steel ships is not produced in Canada. In this industry steel plates and bars are required, and as they are not manufactured in Canada they would have to be imported from England or Germany. This would necessarily be a heavy handicap if an industry of this character were started at the present time. There is, however, every probability of steel for ship building purposes being manufactured in Nova Scotia, in the future, but at present there is no such plant in existence. Another important item which must be carefully considered in the establishment of a steel ship building enterprise is the labor problem. From what I have seen during my visit to Canada I believe that there is a splendid class of material in the dominion, only awaiting the necessary training and experience. It is my firm conviction that the labor which can be obtained, for the purpose of carrying on a great steel ship building enterprise in Canada, will prove quite adequate and worthy of the great natural advantages of this country. I can plainly see the cost of manufacturing steel ships in Canada greatly cheapened in the future. I am persuaded that the cheapest steel ships in the world can be produced in Nova Scotia; but, remember, that the cost of skilled labor will probably always remain higher there than in Europe, but, to counterbalance this, I confidently anticipate a very skilled class of workmen springing up, which will do credit to the country. The higher cost of labor, moreover, will be more than offset by the cheapness of steel production in other directions."

The steamer William G. Payne for the Bridgeport Shipping Co. was launched last Saturday at the ship yard of the Harlan & Hollingsworth Co., Wilmington, Del.

RAPID FUELING SCOW.

Preparatory to the opening of navigation every effort is being made to facilitate the dispatch of boats while in port. This is one of the distinguishing features of improvements along the docks at the present time and is probably more greatly emphasized this season than it ever has been. As corollary to this the Pittsburgh Coal Co. is making unusual efforts to secure dispatch in the fueling of steamers. C. O. Bartlett & Co. of Cleveland are at present building for the Pittsburgh Coal Co. a fueling scow which, it is intended, shall approach a steamer on the water side while it is at dock and fuel it without disturbing the operation of discharging its cargo. The scow will have a capacity of from 250 to 300 tons per hour. The accompanying cuts show a general outline of the new fueling scow, the general construction and operation of which is as follows: The scow ordinarily used is about 165 ft. long and 25 ft. wide, being large enough to carry 750 tons of coal aside from her machinery. The main body of the scow is provided with hoppers which go nearly the entire length of the scow, being made in two rows, one on each side. In the center of the scow and at the bottom is a tunnel or opening which extends the length of the pockets or hoppers. All of these hoppers are provided with outlets about 3 ft. square for delivering the coal from these pockets onto the conveyor, which travels the entire length of the hoppers and on the bottom of the scow. This conveyor consists of two strands of very heavy steel chain, to which is fastened flights which convey the coal as it is delivered from the hoppers to the end of the conveyor, where it is conveyed up a short incline and delivered into an elevator. The main body of this elevator consists of sheet iron plate, to which is fastened angles, which form the guides for the chain. There are also two strands of heavy steel chain in this elevator to which are fastened buckets centrally hung, and which take the coal as it leaves the conveyor and elevates it up and delivers it into a centrally located hopper, mounted on a turntable. Immediately under this hopper is the lower end of an inclined elevator. This elevator is so arranged that the outer end can be raised or lowered so that it will deliver coal to the vessels to be fueled at any angle from the horizontal to 45 degrees. To the upper end of this inclined elevator is attached a telescope spout. This telescope spout is so arranged that it can be swung out or in to accommodate itself to the hatch of the boat, which is being loaded, and also raised and lowered as may be desired. The motive power for this inclined elevator is derived from a double cylinder engine of sufficient capacity which is located on top of the turn-table. This engine also operates the telescope spout and furnishes power for turning the turn-table by means of which the inclined elevator can be turned to fuel the boats on either side of the scow. There is also provided a double cylinder engine of sufficient power which is mounted on the deck of the scow for operating the conveyor and elevator.





THE ELEVATOR WITH ITS TELESCOPIC SPOUT.

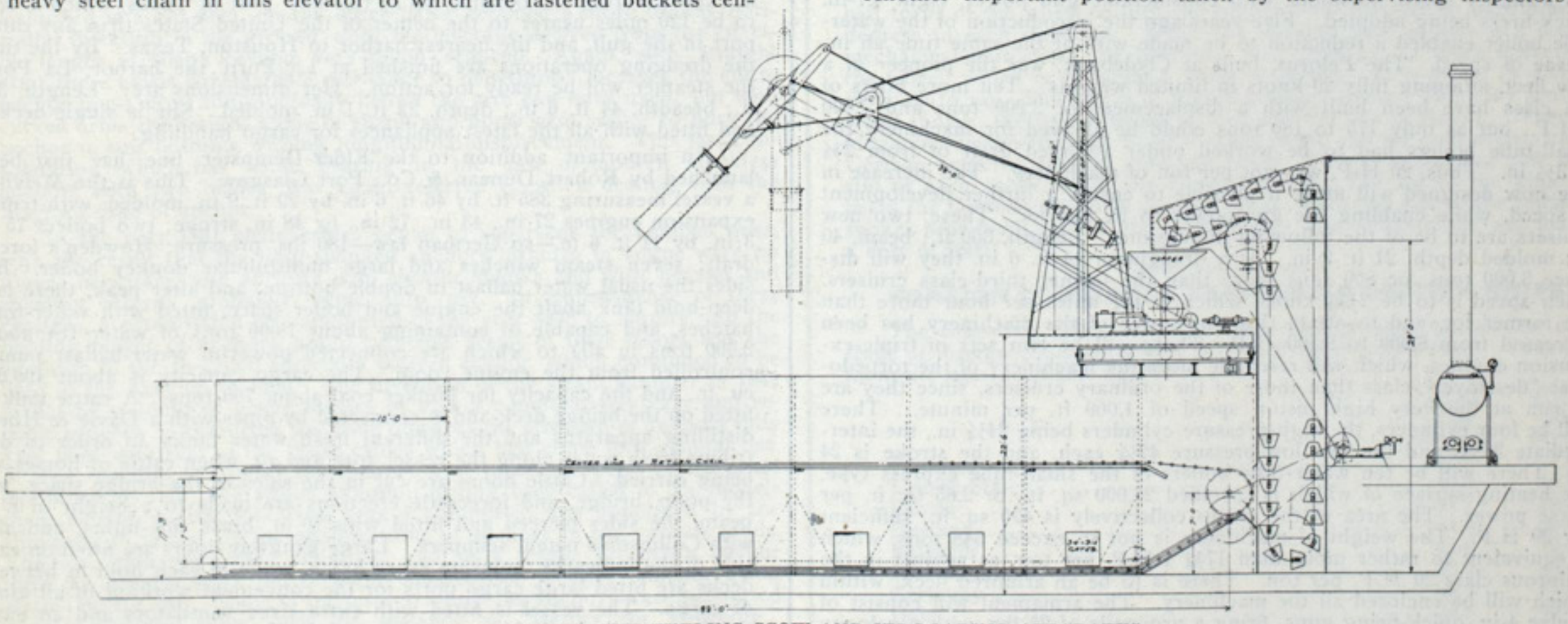
Both engines are supplied from a boiler situated on the deck of the scow. Everything is made extra strong, being especially designed for the work it is intended to do.

C. O. Bartlett & Co. have been instrumental in building many coal handling machines, having built and placed on the great lakes several of their patented coal handling devices, especially adapted for handling large quantities and ranging in capacities from 250 to 300 tons per hour. There are in operation on the great lakes at the present time two large fueling scows which were equipped by them.

CHANGES IN STEAMBOAT INSPECTION.

During their recent meeting in Washington the government inspectors of steam vessels made several changes which will be of the utmost importance to owners and licensed officers on the lakes and ocean. The big change which will this year be insisted upon is that all boilers must be equipped with fusible plugs made of brass and banca metal filling. The inspectors will not pass a vessel which has not had its boilers fitted with these plugs. One of the strict measures adopted by the supervising inspectors is that many of the old style of plugs will not be accepted, only those passing inspection which bear the stamp of the manufacturer, who must file with the inspectors a certificate as to the material used in the manufacture of the plugs.

Another important position taken by the supervising inspectors is that they may hereafter anticipate the expiration of licenses of masters, engineers and pilots thirty days ahead of the actual expiration and renew the papers during the winter when business is dull. This will enable licensed officers to renew their papers three months ahead of their expiration, or before they leave their home ports in the spring, thus doing away with the trouble and annoyance of returning to the inspectors their papers for renewal. Many of the papers run out in April, May and June, and during this time the office force of the supervising inspector is overcrowded, and the new move was to shift a large part of this work into the dull months as well as to make it easier for the officers whose licenses need renewing.



SHOWING THE NEW FUELING SCOW AND ITS LOADING APPARATUS.

SCOTCH SHIP BUILDERS AND THEIR WORK.

BY BENJAMIN TAYLOR.

Glasgow, Feb. 1.—Our ship builders begin the year not only with a large amount of work on hand (though not so large as at the beginning of last year), but with the advantage of easier prices for material. The North of England steel makers took the initiative last week in reducing steel ship plates 5s. per ton, and the price is now about £2 per ton under the maximum reached in 1900 and near to the lowest point touched during the depressed portion of last year. Among the work on hand, the London & Glasgow Ship Building Co., Glasgow, have a first-class cruiser and a 4,000-ton cargo boat. William Beardmore & Co. have a first-class cruiser and three large boats, and are rapidly completing their new yard at Dalmuir. The Fairfield company have a County type cruiser, a big liner for the Ocean company and two liners for the Pacific Steam Navigation Co. A. & J. Inglis have four British India liners and other craft. D. & W. Henderson & Co. have a big Anchor liner and three other large boats. Barclay, Curle & Co. have three large steamers just begun, and two smaller ones fairly forward. Charles Connell & Co. have four large boats and two smaller ones. Alex. Stephen & Sons have five large steamers in various stages. John Brown & Co., Clydebank, have large boats for Sir Christopher Furness and other owners, and also some river boats. William Denny & Bros., Dumbarton, have enough work on hand to keep them busy all the year. A. Rodger & Co. have still two big sailers to build for the Anglo-American Oil Co. Caird & Co. have two 10,000-ton P. & O. liners and two 6,000-ton boats for the Pacific company. Scott & Co. have a 12,000-ton boat for the Anglo-American Oil Co., two 6,000-ton cargo tramps and a British India liner of 4,000 tons. These notes refer to vessels actually on the stocks, not to vessels already in the water and awaiting completion; and this is but a fraction of the work on hand on the Clyde.

What is now being looked for is a share of the admiralty contracts to be placed within the next few weeks. Tenders have been sent in for five armored cruisers to be built by contract, as well as for the machinery for a sixth to be constructed at Chatham dock yard. The Yarrow large-tube boiler is to be adopted for these vessels, the tubes of which being only a few degrees inclined from the vertical, and water-drowned at both ends, give an effective water circulation. The tubes are expanded into the lower water drums, which have a flat surface to receive them, and also into the upper central steam drum, so that the boiler is free throughout from the screwed joints said to be the chief source of loss of water in the Belleville boiler. The coal consumption is regarded as a doubtful quantity. In Holland and Denmark the large-tube Yarrow boiler is largely adopted. The new cruisers are to be of the County class, similar to ten vessels now under construction, five on the Clyde, one on the Tyne, and four in the dock yards. The vessels will have a displacement of 9,800 tons and the engines will indicate 22,000 H.P., giving a speed of 23 knots. The principal difference from the last lot is in the substitution of a centrally-mounted 7.5-in. quick-firing gun for the two 6-in. guns on twin mountings in a turret at the forward end, and a similar substitution aft. As in the earlier boats there will be ten 6-in. quick-firers in casements, five on each broadside.

According to the original program, there were to be two new battleships built in the dock yards and one by contract, but it has now been decided to let out two on contract. Tenders are being considered for these as also for two protective-deck cruisers included with the five armored cruisers in the program. These two protected cruisers are to be third-class vessels, but their displacement of 3,000 tons marks an increase for this class. Twelve years or so ago the third-class cruiser was a vessel of 1,700 tons of the Scout class; but when the naval defence fleet was arranged ten years ago there was a desire to get a higher speed, 19 knots, with considerable gun power, eight 4.7-in. quick-firers being adopted. Five years ago the introduction of the water-tube boiler enabled a reduction to be made with at the same time an increase of speed. The Pelorus, built at Clydebank, was the pioneer of a new fleet, attaining fully 20 knots in limited weights. Ten more boats of the class have been built with a displacement of 2,200 tons and 7,000 I.H.P., but as only 175 to 180 tons could be allowed for machinery the small-tube boilers had to be worked under a forced draft of from 2¾ to 3½ in. Thus, 20 H.P. was got per ton of machinery. The increase in size now designed will make it possible to ensure a further development of speed, while enabling the gun-power to be heavier. These two new cruisers are to be of the following dimensions: Length, 360 ft.; beam, 40 ft.; molded depth, 21 ft. 9 in. At a draught of 14 ft. 6 in. they will displace 3,000 tons, or 800 tons more than the former third-class cruisers. Their speed is to be 21¾ knots, which is 1¾ miles per hour more than the former lot, and to attain this the power of the machinery has been increased from 6,000 to 9,800 H.P. There will be two sets of triple-expansion engines, which will resemble more the machinery of the torpedo-boat "destroyer" class than those of the ordinary cruisers, since they are to run at the very high piston speed of 1,000 ft. per minute. There will be four cylinders, the high-pressure cylinders being 24¼ in., the intermediate 38½, and the two low-pressure 42¼ each, and the stroke is 24 in. There will be ten water-tube boilers of the small-tube express type, the heating surface of which is specified 26,000 sq. ft., or 2.65 sq. ft. per horse power. The area of the grates collectively is 490 sq. ft., sufficient for 20 H.P. The weight of machinery is not to exceed 548 tons, which is equivalent to rather more than 17¾ I.H.P. per ton, as against in the Pelorous class 20 H.P. per ton. There is to be an armored deck, within which will be enclosed all the machinery. The armament will consist of twelve 4-in. quick-firing guns, firing a projectile of 25 lbs. with a velocity of 2,300 ft. per second, and eight guns firing three-pounder shots, and three Maxim guns. Each cruiser will have two submerged torpedo tubes.

It is now reported that during last year there were launched for the French navy, four armored cruisers, two torpedo-boat destroyers, three torpedo boats, and six submarine boats, with four other submergible boats, the total being 40,757 tons, with machinery of 104,500 I.H.P. This compares with thirty-two vessels of 209,100 tons for the British navy, of a total of 389,200 I.H.P. The British list includes six battleships, ten armored cruisers, three sloops, two gunboats, two torpedo-boat destroyers, four torpedo boats, and five submarine boats. France has laid down for construction two battleships, an armored cruiser, eleven torpedo-boat destroyers, eleven first-class torpedo boats and twenty-three submarine boats, the total tonnage being about 54,000 and the horse power 92,000. In Great Britain there have been laid down twelve vessels, all, with two exceptions, of large dimensions, the total tonnage being 102,700, while the collective power of machinery is 180,100 I.H.P. This is about double the new work begun by France, but within the next few months will be laid down, in addition, three battleships, six armored cruisers, and two third-class cruisers, with an aggregate of 130,300 tons and of 200,000 I.H.P.

Most American visitors coming to Europe, and landing or embarking at Queenstown, make the passage between Dublin and Holyhead. A vessel for this service, the fourth built by William Denny & Bros., has just been launched. She is built to an extremely beautiful model, the lines being very fine, in order that the high rate of speed required in this service may be maintained. The draught of water both at Holyhead and Dublin being extremely limited, great care was necessary in designing the vessel. She is sub-divided into numerous water-tight compartments, so that she will remain afloat with any single compartment bilged, and in several cases with two. Trimming tanks are provided so that the vessel may be brought to any desired trim, regardless of the condition of loading. The leading dimensions are: Length, 338 ft. 3 in.; breadth molded, 39 ft.; depth to awning deck, 24 ft. 9 in. The Scotia, as she is named, is built of mild steel throughout, with straight stem and elliptical stern, and awning deck extending continuously from end to end, above which the boats are carried on a boat-deck out of the way of the passenger promenade. There is a long range of casings and deckhouses on this deck containing special state-rooms and ladies' and gentlemen's deck cabins. The propelling machinery consists of two sets of triple-expansion engines, supplied with steam at 160 lbs. per square inch by eight single-ended boilers. There are four cylinders to each set, having cast-steel pistons, the high-pressure and low-pressure cylinders having piston valves, with relief rings on back, and Joy's balance pistons on top of spindles. The piston rods, connecting rods and valve gear, are of mild ingot steel, and the valve gear is controlled by Brown's combined steam and hydraulic reversing gear. The crank shaft is built of mild ingot steel and is hollow as are also the crank pins. The sole plate and guide columns are of cast steel, which material is also used generally throughout the engines in place of cast iron, in order to obtain greater strength and lightness. The engines are balanced on the Otto-Schlick principle, so as to avoid vibration. The circulating pumps are of the centrifugal type, and are arranged to pump out the machinery spaces and holds in case of serious leakage, thus forming a valuable auxiliary to the main pumping system. The feed pumps are also independent of the main engines, and are two in number, each being able to do the whole work if required. The feed water passes through a feed heater and filter, or may be sent direct to the boilers by means of an arrangement of by-pass valves and pipes, as desired. The boilers are constructed of mild steel to board of trade requirements, and each is fitted with three corrugated steel furnaces, with independent combustion chambers. The boilers are grouped in two separate stokeholds, and are arranged to work under forced draft, for which purpose four large fans are fitted. The system of duplication has been carried out wherever possible, so that the vessel may be considered perfectly safe, even in the very remote contingency of a breakdown of half her machinery. These Holyhead and Dublin packets are among the swiftest vessels afloat.

A vessel of peculiar interest was launched a few days ago by the Grangemouth & Greenock Dockyard Co., Greenock, viz: the pioneer of a new line of cotton steamers. La Porte is a boat of 4,000 tons, named after the new harbor in the gulf of Mexico, from which she will bring cotton direct to Manchester, in the service of a London company. Much is expected from the opening up of this new port in Texas, which is said to be 120 miles nearer to the center of the United States than any other port in the gulf, and the nearest harbor to Houston, Texas. By the time the dredging operations are finished at La Porte the harbor, La Porte the steamer will be ready for action. Her dimensions are: Length, 300 ft.; breadth, 44 ft. 6 in.; depth, 22 ft. 1 in. molded. She is single-decked and fitted with all the latest appliances for cargo handling.

An important addition to the Elder-Dempster line has just been launched by Robert Duncan & Co., Port Glasgow. This is the Melville, a vessel measuring 385 ft. by 46 ft. 6 in. by 29 ft. 9 in. molded, with triple-expansion engines 27 in., 43 in., 72 in., by 48 in. stroke; two boilers 15 ft. 3 in. by 11 ft. 6 in.—to German law—180 lbs. pressure; Howden's forced draft; seven steam winches and large multitubular donkey boiler. Besides the usual water ballast in double bottom, and after peak, there is a deep-hold tank abaft the engine and boiler space, fitted with water-tight hatches, and capable of containing about 1,000 tons of water (or about 2,000 tons in all) to which are connected powerful water-ballast pumps controlled from the engine room. The cargo capacity is about 400,000 cu. ft., and the capacity for bunker coal about 700 tons. A cattle tank is fitted on the bridge deck and is connected by pipes with a Davie & Horne distilling apparatus and the different fresh water tanks, in order to distribute fresh water along the vessel, fore and aft, when cattle or horses are being carried. Cattle doors are cut in the sides of the bridge space, and the poop, bridge, and forecastle erections are made to a height of 8 ft. beam, the sides pierced and fitted with 10-in. brass side-lights, and also with Collinson's patent scuppers. Large gangway doors are fitted on each side of the bulwarks, opposite every hatch, while in each hold in between decks are fitted large cargo ports for the convenient working of all kinds of cargo. The vessel is fitted with extra sized ventilators and an extra number to all the holds, extra water-tight doors, and an extra number of coaling hatches in bridge and main decks, ice-house in bridge of ample dimensions, additional fan engine for forced draft, increased height of all erections and engine and boiler casings, additional appliances for loading and discharging cargoes.

The Clyde Steamship Owners' Association received last year an accession of 415 vessels, with a total tonnage of 808,806 tons. In the annual report of this association it is stated that an anomaly in connection with the measuring of timber deck-cargoes of Greenock was brought under the notice of the directors by a member. According to the merchant shipping act, where deck cargoes are carried all dues payable on the ship's tonnage are to be payable as if there were added to the ship's tonnage the tonnage of the space occupied by the goods, and "the space so occupied shall be

deemed to be the space limited by the area occupied by the goods and by straight lines enclosing a rectangular space sufficient to include the goods." One of this member's steamers arrived at Greenock with a deck load, according to the sworn measurer's certificate, of 310 loads of 50 cu. ft., say 15,500 ft., or 155 customs tons of 100 cu. ft.; but she was assessed for light dues on 224.25 customs tons, and this carried with it the obligation to pay harbor dues on that tonnage. On a previous voyage the same vessel had carried a deck load of 337 loads, measuring 169 customs tons, but while on that occasion the deck cargo measured fourteen customs tons more than in the present instance, the customs officer's measurement was 22 tons less. Several other similar cases were also given by the member. From this it appears that the customs' mode of measurement at Greenock includes a hypothetical space far in excess of the space occupied by the cargo. The directors were of opinion that the measurement ought only to include the actual cubical contents of the deck cargo, and as no satisfaction could be obtained from the customs' officials at Greenock, the board of trade were addressed on the subject. After a prolonged correspondence with that body, who, however, adhered to the opinion that the Greenock officials had acted in accordance with the merchant shipping act—the board of trade gave instructions to the collector of customs at Greenock that in cases where doubt is entertained as to the correct measurement of the deck cargo of a vessel arriving there, the chief officer of the vessel is to be allowed to check such measurement with the customs officer.

ANCHORS.

In the paper read before the Shipmasters' Society, at the London chamber of commerce, Eastcheap, recently, Capt. Anthony S. Thomson, C. B., dealt with certain stages in the development of the anchor, the object being to arrive at sound conclusions with regard to the functions of the different parts of an anchor, and the value of recent modifications. After dealing briefly with the earliest forms of anchors, grapnels, mushrooms, and the ordinary stocked anchor, the author went on to state that the ships' anchors in general use up to the beginning of last century consisted of a long, round iron shank, having two comparatively short straight arms or flukes, inclined to the shank at an angle of about 40 degrees, and meeting it in a somewhat sharp point at the crown. In large anchors the bulky wooden stock was built up of several pieces hooped together, the whole tapering outwards to the ends, especially on the after or cable side.

Continuing, the author said that about the commencement of last century, a clerk in Plymouth naval yard, Pering by name, suggested certain improvements, the most important of which was making the arms curved instead of straight. At first sight, this simple change may seem of little value, but consideration will show that this is not the case. The holding power of an anchor depends on two principal conditions, namely, the extent of useful holding surface, and the amount of vertical penetration. The latter quality is necessary on account of the nature of ordinary sea bottoms, the surface layers of which are generally less tenacious and resisting than is the ground a short distance below. Now the measure of penetration, and also, to a limited degree, that of useful holding surface, is the vertical distance from the lower portion of shank to the pea, or extreme end of the arm, when fully buried. The distance evidently depends on the length and on the inclination of the arm. Some inclination the arm must have, in order to bring about penetration; yet the more at right angles to the shank, the greater the penetration. These two opposing conditions are reconciled by curving the arm to the arc of a circle having its center in such a position that the radius of the curve is about a third of the length of shank. Two minor advantages also accrue. During the process of tripping or breaking out the anchor, the buried arm continues its curved path in the ground until the shank is nearly vertical and the pea ready to emerge with the least possible resistance. The old-fashioned straight arm, on the other hand, retained a more or less horizontal direction in the ground, until the leverage derived from the effective length of shank became very much reduced. Again, with straight arms there exists considerable resistance to penetration, because the entire anchor must move longitudinally before the arm can bury itself; but with curved arms the weight alone of shank and upper arm suffice to bury the anchor in soft bottoms without longitudinal displacement. This last consideration, which has some bearing in the case of modern stockless anchors with two blades, was again referred to when dealing with the Martin's type of anchor.

In the year 1831 chain cables began to supersede the hempen ones, with the result that the long-shanked anchors hitherto in vogue were no longer necessary, and anchors with shorter shanks and with heavier and stronger crowns gradually came into use. In consequence of these changes, a commission was appointed in the year 1838 to inquire into the holding power of anchors, and a principal result of their labors was the adoption of the so-called admiralty pattern anchor, which continued to be used in the navy up to 1860. The invention of the steam hammer in 1842 made the welding of heavy masses of iron a comparatively easy and reliable process, so that from this time onwards the strength of anchors fully kept pace with that of the chain cables which had come into general use. A great number of patents for anchors were taken out prior to the great exhibition of 1851, and public attention having been called to the models there shown, in the following year a committee was appointed by the admiralty to report on the qualifications of anchors of the various kinds. Practical trials were then instituted, and, as a result, Trotman's anchor took the highest place out of eight competitors, Rodger's anchor being second on the list. Some of the tests to which the anchors were submitted were of doubtful value, such for instance, as "facility for sweeping." Nowadays, at all events for deep ships in shallow harbors, it is considered an advantage for an anchor to offer as little obstruction as possible above the ground. In this particular test, as also in some others of small importance, Trotman's anchor was handicapped as against those of ordinary form, yet it came out first owing to its undoubted superiority in holding power. The author then described the structure and qualities of the two anchors last referred to, which may be taken as types of the best stock dependent anchors. Hawse stowing anchors, the strength and weight of anchors, some experiences of tramp steamers dragging their anchors, and a sketch of recent developments of stockless anchors were also dealt with.

CANADIAN STEAMSHIP RATE AGREEMENT.

Word comes from Montreal that in addition to the general agreement entered into recently by the Atlantic steamship lines regarding minimum rates on certain kinds of freight, there is a second agreement that takes in the lines running between United States and Canadian ports and Glasgow. This second agreement affects more especially the lines that handle the Canadian business and it was effected, Canadian dispatches say, mainly through the endeavors of A. A. Allan of H. & A. Allan and W. T. Gear of the Robert Reford Co., both of Montreal. Early in December they came to New York with the idea of making some arrangements, if possible, with the other steamship companies engaged in the Glasgow trade.

While not meeting with much success at the outset an agreement was finally drawn up and signed by the following lines: H. & A. Allan for the ports of Montreal, Portland and Boston; the Robert Reford Co. (the Donaldson line) for Montreal, Portland, and St. John; Henderson Bros. of the Anchor line, Austen, Baldwin & Co. for the Allan-State line, New York; Patterson, Ramsay & Co. for the Donaldson line, Baltimore; United States Shipping Co. for the Donaldson line from Newport News, and H. & A. Allan for the Philadelphia service.

According to the agreement which was signed on Jan. 20, the minimum rate between any of the above-mentioned ports and Glasgow shall be as follows: Cheese, 25 shillings; butter, in cases and kegs, 5 shillings over cheese rate; leather, dressed, in cases and rolls, 20 shillings; eggs, in cases or barrels, 15 shillings; apples and other green fruit, in boxes, 12s. 6d.; apples, in barrels, 2s. 6d per barrel. It is also further agreed that Boston, New York, Philadelphia, Baltimore, Newport News and Norfolk shall quote Montreal quotations exclusively in Canada for all classes of goods, hay alone excepted, and, further, that the Montreal tariff shall be mailed to each line regularly. This means, in a word, that there will be no cutting below the Montreal rates on Canadian produce. The companies have also agreed upon a minimum passenger rate. The minimum saloon rate between a Canadian port and Europe will be $50 during the winter season, which is an advance of from $5 to $10, according to steamer and lines, over the minimum rate which has been in force for some time. The Canadian lines affected by this agreement will be the Allan, Elder-Dempster and Dominion, with any of which there will be no first-class winter accommodation for less than $50 per trip.

METEOR'S STEERING APPARATUS.

The German emperor's schooner yacht, the Meteor, will have a steering apparatus which has been specially designed for the yacht by G. D. Loud, treasurer of the Edson Manufacturing Co. of Boston, which is thus described:

"The new steering gear works with wonderful ease—in fact, a child can manipulate it without difficulty. There is also not the slightest lost motion. On the fore and aft screw, one-half of which is forward and the other half aft of the rudder-head, work the connecting straps. The outside diameter of this triple-thread screw is 2⅞ in., the pitch of the screw being 1⅞ in. The connecting straps are of Norway iron, the traversing nuts being of gun metal. Some idea of the power of the steering gear may be gained from the statement that a sample pouring of the cast iron in the rudder-head casting stood a tensile test of 32,307 lbs. to the square inch before breaking, the test having been made by Prof. E. F. Miller of the Massachusetts Institute of Technology. The rudder-head swivel-box is made of gun metal, while the rudder-head is of steel, 3½ in. in diameter. The rudder-post has a rake of 33 degrees. The ball-bearing supports for the rudder-post rest on thirty-two steel balls, running on case-hardened steel plates, with four adjusting screws, which provide for the wearing strain on the rudder pintles. The gear is also provided with two taffrail boxes, one forward and one aft, with rubber springs. It takes five and a half turns of the wheel to turn the rudder from hard up to hard down, 45 degrees in each direction. While the steering gear proper is a piece of mechanical perfection, the landsman will, perhaps, be more attracted to the wheel, which is certainly a thing of beauty. It is 54 in. in diameter from tip to tip. The hub is of highly polished brass. There are ten rosewood spokes, the felloes being of teak and the rim of ebony. Where the kingspoke passes through there is inlaid in the rim the coat-of-arms of the German emperor done in gold and silver. On the remaining part of the rim at each spoke is set the German cross. The tip of the kingspoke bears the German crown in German silver, while the tips of the remaining spokes bear plain caps of the same metal. The wheel alone was made at a cost of $500."

FOREIGN COMMERCE CARRIED ON BRITISH SHIPS.

The following table shows the exceedingly large proportion of the trade of foreign countries which is carried by British vessels. It is based upon the latest available figures:

	Under the British Flag. Per cent.	Under the National Flag. Per cent.
Portugal	57.3	7.3
United States	52.8	16.9
Russia	44.7	10.3
Holland	44.6	25.0
Belgium	44.6	16.3
France	43.0	28.4
Germany	29.9	47.5
Italy	23.8	48.8
Norway	12.0	66.1
Sweden	12.0	38.3

The new ship yard which Philadelphia capitalists contemplate establishing at Sewell's Point, which lies across Hampton Roads directly opposite Newport News and Old Point Comfort, seems to be an assured undertaking. According to C. W. Tebault of Norfolk, who has recently returned from Philadelphia, where he went on business in connection with the plant, the plans of the project are not dying by limitation. The men who are behind the venture will arrive here in a few days and look over the ground with a view of beginning work. The capital stock of the company, which has been incorporated, is $3,000,000.

AMERICAN COAL TO EUROPE.

AN EXHAUSTIVE STUDY OF THE TRANSATLANTIC SHIPMENT OF COAL IS MADE —WHAT THE ACTUAL COST OF OPERATION WOULD BE.

Messrs. Holmes and Goodenough of No. 21 State street, New York, have, at the request of the Coal Trade Journal, made an exhaustive report upon the transatlantic shipment of American coal for the benefit of those who, seeking a safe and profitable investment, may have had their attention turned in that direction. The article was prepared after consultation with a number of gentlemen prominent in shipping and coal circles. The major part of the article is as follows:

Thanks to the improved working methods and the judicious introduction of the most efficient mining machinery, the American output of coal exceeds that of the United Kingdom, while it is admitted that in calorific qualities the coal is fully equal to the very best British. Consular reports from various parts of Europe show that American coal has long been favorably known, and that, but for the lack of economical and systematic transportation, a regular and profitable trade would long ago have been established. That only ships of large size can be truly economical in carrying cargoes like coal across the Atlantic is evident, and it is our purpose to show how a steamer, specially designed for the coal trade and carrying 10,000 tons, can be economically operated.

For comparison's sake we will state the first cost and running expenses of a steamer built in the United States and operated under the American flag, and of one built abroad and sailing under a foreign flag.

The highest skill whereof the naval architect and marine engineer are capable would have to be exercised in producing a steamer, which would be at the same time of moderate first cost, staunch and seaworthy, economical in the consumption of coal and easy of handling. That a steamer carrying coal to Europe would in most cases have to return in ballast, is probable, but it is believed that even under such conditions the undertaking would be a paying one, and it is not to be doubted that, when once the trade is properly established, some kind of return cargo will be found. Very large shipments of Spanish iron ore are being made to the United States, and for such a cargo the ship now contemplated would be eminently suitable.

The steamer in question would be about 460 ft. long on the water line and 58 ft. beam, and approximately 6,500 tons gross and 4,400 tons net tonnage, and would carry her cargo of 10,000 gross tons of coal on a draught not exceeding 26 ft. The propelling machinery would be of a power sufficient for a mean speed of 10 knots per hour at sea, and placed as far aft as possible in order to leave, for the greater convenience in loading and discharging, a series of hatches, equally spaced. Provision would be made for water ballast, not only in double bottom but also in deep tanks, so that, in addition to obtaining the requisite immersion for proper working of the propellers, the center of gravity of ballast would be sufficiently high to ensure the ship's easy behavior in a seaway. While it is well known that at several European ports the facilities for loading and discharging are not at present such as could accommodate a ship of 10,000 tons, drawing 26 ft., these facilities will no doubt be forthcoming when it is clear that a permanent trade of great magnitude has been firmly established.

For a long time Great Britain has been seriously concerned about her coal supply, and fears are now frequently expressed that the exports are excessive, this condition of affairs being emphasized by the appointing of a royal commission to inquire into the possible exhaustion of the coal fields. As a consequence of decreased exports, the price of British coal on the continent of Europe cannot fail to rise, thus rendering the outlook for American transportation considerably brighter.

The machinery for such a vessel as we are considering must necessarily be in keeping with its ship, and, therefore, will be as economical as is possible to make it without the introduction of mechanism and parts which will require the services of a greater number of more skillful engineers, or need a greater amount of repairs than is given to first rate vessels of the present time. The average modern vessel built since 1896 consumes 1.6 lbs. of coal per indicated horse power per hour, the lowest known consumption of marine engines being .97 lbs. per indicated horse power obtained on a trial trip. There should, however, be no great difficulty in obtaining machinery capable of 1¼ lbs. of coal per indicated horse power per hour. While twin screws would slightly decrease the efficiency of the motive power as a whole, in the average of a year crossing the Atlantic ocean they would amply make up for it in speed during light draught and in heavy seaways. The rate of insurance should also decrease as a result of having duplicate machinery. There will be no addition to the engine-room force at this power because of the duplication.

Any reasonable sum spent in making a vessel of this class economical is money well spent. For instance, suppose we save ¼ lb. of coal per indicated horse power per hour; then with 3,000 indicated horse power, 300 days of steaming per year, the total saving of fuel in one year on this size of vessel would amount to 2,410 gross tons, and with bunker coal at $3.00 per ton this means a gross saving in running expenses of $7,230. And further, let us assume that in order to obtain machinery of this description we are obliged to add $20,000 to the first cost, and this is a liberal amount; with capital cost per year at 15½ per cent. (insurance, interest, depreciation) of first cost we have the yearly expense of the investment as $3,100. Now deduct this from $7,230 and we shall have a net saving to our running expenses of $4,130 per year. In addition to this we increase the earning capacity of our ship by the amount of extra cargo which we can carry where this bunker coal was. If the cost of transporting the coal is $1.50 per ton, then for ten trips, or one year's work, we could carry 2,410 tons of paying coal at $1.50 per ton, owing to the economy of the machinery. This would amount to $3,615, or a total saving to the ship per year of $7,745, or a profit of 38.7 per cent. on the extra investment. We insert this example because, at least in this country, the economy of steamships is given too little attention.

Coal Consumption.—For reference, a table of distances in knots by the most direct navigable routes between American and European ports is here inserted:

Newport News	to Hamburg	3,602	knots
"	" Havre	3,278	"
"	" Brest	3,101	"
"	" Bordeaux	3,334	"
"	" Marseilles	4,005	"
Baltimore	" Hamburg	3,769	"
"	" Havre	3,445	"
"	" Brest	3,268	"
"	" Bordeaux	3,501	"
"	" Marseilles	4,172	"
Philadelphia	" Hamburg	3,608	"
"	" Havre	3,284	"
"	" Brest	3,107	"
"	" Bordeaux	3,340	"
"	" Marseilles	4,030	"

We assume for the vessel under consideration that she will travel 3,800 knots each way, or a round trip voyage of 7,600 knots.

The economical speed will be 10 knots per hour loaded and 11 knots per hour light, or 240 knots per day loaded and 264 knots per day light, which would make the total steaming days per voyage 30. By the above named speeds we mean 10 and 11 knots as an average at sea all the year around, which would mean trial trip speeds of 11½ to 12½ knots.

We shall assume the loading and unloading appliances on the docks to which this vessel will go to be of modern construction and that the total lay days per voyage will not be greater than five. That such speed of stevedoring can be easily obtained is within the author's knowledge. Then, from the above, we have a voyage taking 35 days, or let us say ten voyages of 7,600 knots per year, with a vacation for overhauling.

As we have just determined, the number of days steaming are 300, which, with 3,000 I.H.P., 1¼ lbs. consumption of coal per indicated horse power we will have a total yearly consumption for steaming purposes of 12,000 tons. For work in port, such as running winches, banking fires, galley purposes and electric light, we may allow 300 tons, making a total of 12,300 tons bunker coal per year. At $3.00 per ton this would amount to $36,900.

Wages.—It is not the intention of this article to advocate the operation of vessels under any one flag, but the difference in wages, maintenance and capital cost is so variable between different countries that it becomes imperative in order to be clear to state cost under different flags. To this end we tabulate from conservative and authentic sources the wages, maintenance and capital costs of vessels operated under the American, British and Scandinavian flags. In this table below we include such men comprising the crew of the vessel as will be sufficient to keep her thoroughly keyed up to her duty as a machine for carrying coal. The bunkers would be made self-trimming to the extent that no trimmers will be necessary in the stoke hold. As many managers consider it good business to encourage their captains and engineers with a yearly bonus, we have added that also.

On account of the British and Scandinavian vessels not touching at home ports each trip, the wages for these steamers will be considerably in excess of what they would if the crews were signed at home.

Rating.	American. Rate.	American. Total per month.	British. Rate.	British. Total per month.	Scandinavian. Rate.	Scandinavian. Total per month.
Captain		$200.00		$145.00		$130.00
First officer		90.00		51.03		35.00
Second officer		70.00		36.45		28.00
Third officer		50.00		29.16		21.00
Three quartermasters	$30.00	90.00	$21.87	65.61	$15.00	45.00
One carpenter		40.00		31.59		17.50
Six sailors	25.00	150.00	20.65	123.90	10.50	63.00
One cook		60.00		31.59		17.50
One messboy		25.00		14.58		5.00
Chief engineer		150.00		87.11		75.00
First assistant eng.		90.00		62.10		50.00
Second assistant eng.		75.00		45.14		40.00
Third assistant eng.		60.00		34.02		28.00
Four oilers	40.00	160.00	23.08	92.32	15.00	60.00
Ten firemen	40.00	400.00	23.08	230.80	15.00	150.00
Total per ship per month		$1,710.00		$1,081.20		$765.00
Total per ship per year		20,520.00		12,974.40		9,180.00
Bonus		200.00		200.00		200.00
Grand total		$20,720.00		$13,174.40		$9,380.00

Maintenance of Crew.—The cost of maintaining the crew varies greatly, as can be seen below. The extent of the bill of fare is not interfered with by the British government, and private agreement brings it greatly below that permitted by the laws of the United States. The values given below will be found to be a fair average:

	American.	British.	Scandinavian.
Cost per man per day	$ .45	$ .35	$ .30
Cost per 34 men per day	15.30	11.90	10.20
Cost per year of 360 days	$5,508.00	$4,284.00	$3,672.00

Tonnage Dues.—The gross registered tonnage for a vessel of the description which we are considering is about 6,500, and the net registered tonnage about 4,400.

The tonnage tax of all vessels entering United States ports from foreign ports is 6 cents per ton per entry, not to exceed 30 cents per ton per year. Thus the United States tonnage charges on our vessel will amount to $1,320 per year. The tonnage tax of vessels entering French ports is one franc (19.3 cents) per net registered ton if the total number of tons discharged is greater than half the net registered tonnage. For ten entries per year this would be $1.93 per ton per year, or a total of $8,492. To this has to be added a sanitary tax of 15 centimes per ton, which adds $127.38 yearly, making a total of French port dues of $8,620, or, in order to cover fire guard, passport and stamp, say about $9,000.

This, added to the United States tonnage dues, would make a total yearly port charges of $10,320, on the basis that the loading coal pier is owned by the steamship company and that the vessel pays such charges in France as enable her to tie up to a wharf, but does not pay for the stevedoring.

Pilotage Charges.—The pilotage charges vary so greatly with all ports, depending upon accessibility, that in considering those of vessels entering the United States we shall take the rates used in New York harbor. Our vessel entering an American port, light, would draw about 16 ft. maximum. The inward pilotage would then be $67.60 and the outward $37.28, making a total pilotage of $104.88, and for ten voyages $1,048.80, or say $1,000. The pilotage entering the port of Marseilles is 43 centimes inward and 15 centimes outward per net registered ton, making a total of 58 centimes per ton, which on a 4,400-ton ship amounts to 2,552 francs, or $492.53 per entry. For ten entries or one year $4,925, say $5,000. Adding the American pilotage charge we have a total of $6,000 yearly.

Towage.—For towage bills we will allow $5,000 per year.

Capital Expense (interest, depreciation and insurance).—We now come to what is in the American vessels 48 per cent. of the expense of running, and in the British 43 per cent.; by far the largest single item on the cost sheet. The first costs upon which we have based the following figures are conservative and vessels could today be built on these lines and for these figures. It has been suggested that a depreciation of 7½ per cent. should be allowed, instead of 5 per cent., because of the rapidity with which all appliances become old-fashioned in this present age. On the other hand, such a vessel, well cared for, should be, and probably would be, at the end of ten years, sold for half her cost, which would amount to 5 per cent. depreciation for twenty years.

	American.	British.	Scandinavian.
First cost	$510,000.00	$370,000.00	$370,000.00
Interest 4½% mortgage	22,950.00	16,650.00	16,650.00
Depreciation 5%	25,500.00	18,500.00	18,500.00
Insurance 6%	30,600.00	22,200.00	22,200.00
Total capital cost 15½%	$79,050.00	$57,350.00	$57,350.00

Total Yearly Operating Cost.—We may now combine all the footings in the foregoing items and obtain the cost of carrying each ton of coal 3,800 knots to Europe, and bringing the vessel back light.

	American.	British.	Scandinavian.
Coal consumption	$36,900.00	$36,900.00	$36,900.00
Wages	20,720.00	13,174.00	9,380.00
Maintenance of crew	5,508.00	4,284.00	3,672.00
Tonnage dues	10,320.00	10,320.00	10,320.00
Pilotage	6,000.00	6,000.00	6,000.00
Towage	5,000.00	5,000.00	5,000.00
Capital expense	79,050.00	57,350.00	57,350.00
Total yearly cost per vessel	$163,498.00	$133,028.00	$128,622.00

The total number of tons carried per year in ten trips being 100,000, the cost per ton will be as follows:

American.	British.	Scandinavian.
$1.635	$1.33	$1.286

Cargo insurance can be obtained on this class of vessel for from ¾ to ½ of 1 per cent., which would make cost of insurance per ton carried about 2 cents.

Assuming that the management expenses of a company operating two such vessels to be $30,000.00 per year, the cost based on a ton of coal carried would be 15 cents. The stevedoring is not brought into consideration, as we are concerned only with the transportation.

COST PER TON OF COAL CARRIED.

	American.	British.	Scandinavian.
Operating cost	$1.635	$1.33	$1.286
Cargo insurance	.02	.02	.02
Management	.15	.15	.15
Total cost of transportation	$1.805	$1.50	$1.456

Cost of a ton of coal aboard ship lying alongside quay, but not unloaded, in Europe:

Cost aboard ship at Norfolk	$2.50	$2.50	$2.50
Cost of freight	1.80	1.50	1.456
	$4.30	$4.00	$3.956

The present prices for coal in France range from $4.75 to $7.50 per ton, depending upon the kind (bituminous or anthracite) and the quality.

As a matter of comparison we state below the cost of coal per ton carried in a 5,000-ton deadweight ship and burning the usual present day amount of coal, viz.: 1.6 lbs. per indicated horse power. Vessel to make ten trips per year, and carrying no return cargo.

	American.	British.
5,000-ton tramp	$2.25	$2.00
10,000-ton special coal steamer	1.80	1.50

It must be borne distinctly in mind that the figures given throughout this article are based on the assumption that no return cargo will be carried.

From the above discussion it is plain that American vessels, hampered by a high first cost and ridiculous employment laws, are hopelessly out of the question in a foreign carrying trade. But there never was, nor is there now, any obstancle to the ownership of British vessels by Americans. It is a logical conclusion that the seller shall deliver his goods to the buyer, and while now we are paying foreign vessel owners for carrying this coal, the time should not be far distant when the American owner of a vessel will be able to effect a through bill of lading from the mine to Europe. This can only be possible, however, by the establishment of "lines" of steamers which will lay the coal down in Europe with utmost economy of time between the mine pit and the European coal dock. The lower the freight rates between this country and Europe are, the better chance American coal will have in the European market. A fleet of steamers of the kind we speak of would be able, by superior economy and advantage of position, to overcome any opposition in transatlantic trade, and, owing to the high cost of coal in England and the low cost in this country, would be able to maintain f. o. b. prices in Europe which would earn substantial dividends.

PASSENGER STEAMSHIP APPOINTMENTS.

General Manager W. C. McMillan of the Detroit & Cleveland and Detroit and Buffalo lines has announced the list of officers who during the coming season are to operate the boats of the two companies. More than ordinary interest is centered in the appointments this year on account of the selection of the masters of the Eastern States and Western States, the magnificent sidewheelers now building to go on the run between Detroit and Buffalo next June.

The master of the Eastern States, which will make her first trip June 2, will be Capt. Duncan McLaughlan. His pilot will be Capt. John McCallum, who, when the Western States is completed and placed on the run about the middle of June or the first of July, will be placed in command of that boat.

The appointments for the season of 1902, as announced by General Manager McMillan, are:

Eastern States—Captain, Duncan McLaughlan; pilot, John McCallum, it being understood that he is to be appointed captain of the new steamer Western States when she is put into commission; chief engineer, J. O. Snider; purser, D. C. Cummings; steward, Edward Pennell.

City of Detroit—Captain, A. J. McKay; pilot, Malcolm McLaughlan; chief engineer, William Huff; purser, Neal McLean; steward, Alfred Welfare.

City of Cleveland—Captain, Archie McLaughlan; pilot, John Lightbody (he being promoted from first officer of steamer City of Mackinac); chief engineer, John F. Hall; purser, George W. Clarke; steward, E. H. Hudson.

City of Alpena—Captain, Matthew Lightbody; first officer, William Kenyon; chief engineer, Almond Phillips; purser, John Sughrow; steward, B. Ransier.

City of Mackinac—Captain, H. J. Slyfield; first officer, Fred Simpson (he being promoted from second to first officer); chief engineer, William McDonald; purser, R. S. White; steward, William Smith.

The new men appointed were Steward E. H. Hudson, on the City of Cleveland, and Steward William Smith, on the City of Mackinac.

Mr. Julian Herring has been appointed assistant chief steward to Louis Thorne, who has been at the head of this department for many years, and is one of the most popular men in the service.

THE ISTHMIAN CANAL QUESTION.

There is at present in Washington a gentleman who has permitted his prejudice to show its heels to his politeness. He has been a pleader in a special cause for so long, has, as it were, walked with it, talked with it and slept with it that he has became intolerant of opposition and, therefore, to provoke his enmity one has merely to differ with him in opinion. No man has done more than Senator Morgan to further the cutting of a canal across the Isthmus of Panama. For a quarter of a century he has labored to this end, doing prodigious quantities of work, but he has allowed his mind to become so unalterably fixed upon a single route—that of Nicaragua—that he will brook no opposition and make no effort to stay the current of his wrath if anyone suggests the advisability of another route. To the ship owning interests Panama presents one claim that appeals to them infinitely more than any other—and that is the fact that a ship may be navigated through the Panama canal in twelve hours, while it could not be navigated through the Nicaragua canal in less than thirty-three hours. This is the paramount advantage of Panama over Nicaragua. But Mr. Morgan, as chairman of the committee on oceanic canals, is brow-beating every witness who dares to say anything in favor of Panama. After Mr. Lampré, president of the French company, appeared before the committee, Senator Hanna took occasion to apologize to him in the name of the senate and of the American people, so severe was Mr. Morgan's handling of him.

On Saturday last Rear Admiral Walker rebelled against Morgan's treatment. Morgan then began by asking all sorts of questions tending to discredit the commission because of its recent report in favor of Panama. Finally, he asked about the progress of negotiations concerning Colombian concessions. Walker said this was information he had received in confidence from the state department, to which he would have to refer the inquiry. Morgan straightened back, and asked if the United States senate, through its committee, was not to have this information. "Not from me," replied Walker. "Do you refuse to answer my question?" continued Morgan. "I do," answered Walker. Morgan then announced that he would report him to the senate as a contumacious witness, and for that the senate is now waiting.

The fact that Senator Morgan holds this committee chairmanship on sufferance may cool his ardor. The steering committee sent to Mr. Hanna and asked him to take it, but out of sentimental regard for Mr. Morgan, who had so long been identified with the canal question, he declined.

Mr. Hanna will, however, present a report on the canal project, substantially on the lines of the Spooner amendment. Whether this will be a majority or minority report is not known, although it is assumed that it will be a minority. Senator Hanna himself does not care how many sign it with him, and has made no effort to canvass the committee. He has for two years made a study of this question as one purely of business, and purposes to see it through on that basis. He regrets that more is not known of the character of the rocks over the Darien tunnel route. The advantages of directness, shortness, and sea-level are so great that Mr. Hanna hesitates to disregard them, even in the interest of the Panama route. He gets in this desire no encouragement from the Isthmian canal commissioners, who regard the tunnel route as impracticable, because of the tremendous cost which it would involve. George Westinghouse is quoted as saying, however, that such a tunnel could be lined with steel, in case the rocks are as shelving as alleged, at a cost which would not be prohibitive. Everybody acknowledges, however, that any consideration of the Darien route means delay, and so the probabilities are that the Panama route will be accepted.

SUBMARINE BOAT AND ITS VALUE.

The submarine boat and its value in warfare is the subject of an article contributed to the current number of the Naval Institute by Lieut. Com'dr W. W. Kimball, in which he draws the following conclusions:

"Personally, I am strongly of opinion that the primary tactical use of submarines will consist in keeping hostile ships 15 or 20 miles away from the defended place, in preventing them from passing through points at bombarding ranges, and, upon occasions, forcing such an extension of the blockading line as to make intervals wide enough for the safe passage of a contained fleet or of merchant craft—in short, of making blockades non-effective, no matter what the force employed. That submarines could do this duty within the area defined seems clear, because within that area it would not be war or common sense to expose expensive ships with large crews, when the chances of war were so largely in favor of the boats.

"The tactical disposition of this primary use has been sufficiently indicated. It would be such that while there would be a certain concert of action, each boat would have to maneuver independently, under general orders to close and strike when possible. The submarine is slow always, and intermittently she is blind; but she has speed enough to be useful when working on interior lines against fast surface craft. She does not altogether lose sense of direction when she becomes blind, for the sake of becoming invulnerable, and she possesses the enormous tactical advantage of the third dimension movement, which is denied to surface craft. She can move out of their field of action without going away—or into it at will. With submarines in the defense of a contained fleet the temptations to use them by the containers would be great; for, although the defensive submarines could drive off the surface craft of the latter, they could not prevent the containing submarines from closing in to prevent the egress of the contained fleet. At present no one knows how much service submarines may be capable of in distant operations, while their proved efficiency shows what may be reasonably expected of them in the coast defense."

NEW YORK NAUTICAL COLLEGE.

The New York Nautical College, No. 130 Water street, New York, has established departments of marine engineering under the direct instruction of Mr. John C. S. McKenzie and of naval architecture under the direction of Mr. George Crouse Cook. The prospectus will be mailed to anyone upon application. The college is turning out a number of lake officers every month. Among those preparing in the navigation department at present for ocean licenses are the following lake men: Capt. Hubert G. Haybarger, steamer City of Rome; Capt. Dufferin Barber, steamer Grace B.; Capt. Frank W. Carter, towing steamer Alert. Among those who completed a course of navigation and obtained ocean licences last winter are: Capt. Joseph W. Norcross, steamer Paraguay; Capt. Robert Smith, steamer Christopher Columbus; Capt. John F. Ahlstrom, steamer Eureka; Capt. William O. Zealand, steamer Monkshaven.

The French torpedo boat Bourrasque, on trial at Cherbourg, has made, with 347 revolutions, a mean of 31.53 knots. She is a Normand boat.

SHIP YARD NOTES.

The steamship City of Memphis, building for the Ocean Steamship Co. of Savannah, Ga., was launched from Roach's Ship Yard, Chester, Pa., last Saturday. Her dimensions are as follows: Length, 397 ft. 6 in.; beam, molded, 49 ft.; depth, molded, 27 ft. The steamer will be schooner rigged and will have a deadweight carrying capacity of 3,500 tons. She will be equipped with triple-expansion engines 28, 46 and 75 in. in diameter with a common stroke of 48 in.

It is understood that the Fore River Ship & Engine Co., Quincy, Mass., is to build a floating dry dock for its own use after designs by Clark & Standfield, London. The dock will be 700 ft. long and 80 ft. wide between altars and will be built in two sections of four pontoons each.

The Risdon Iron Works, San Francisco, will build a 700 H.P. tug for the Spreckles Tow Boat Co. The tug will be 120 ft. long, 24 ft. wide and 12.6 ft. deep. The same company will also build a tug 82 ft. long for the Ship Owners & Merchants' Tow Boat Co.

Capts. John Chisholm and Daniel McDonald of Gloucester, Mass., have contracted with Tarr & James, Essex, Mass., for a new schooner to engage in the halibut fishing trade.

Frank S. Bowker of Phippsburg, Me., will presently begin the construction of a three-masted schooner for Capt. C. A. Smith of Machiasport, Me.

The annealing shop of the Fore River Ship & Engine Co., Quincy, Mass., was destroyed by fire last week, causing a loss of about $20,000, covered by insurance.

Hay & Wright, Oakland, Cal., will build a barkentine oil carrier with capacity of 15,000 barrels, for the Union Oil Co. of Ventura.

The shipping traffic between Hamburg and Australia was doubled last year. In the year 1900 the number of vessels which arrived at that port from Australia and the Australian islands was twenty-nine, measuring 72,000 registered tons. For 1901 the figures are fifty-one vessels and 141,000 tons. In 1900 twenty-five of the vessels were steamers, but last year the steamers numbered forty-five, the steam tonnage respectively being 69,000 and 133,000.

The compound marine engines, both fore and aft and vertical tandem, as built by Marine Iron Works, station A, Chicago, have met with considerable favor on the Atlantic and Gulf of Mexico coasts, that company having built eighteen sets of them for those waters so far this year. 4

BUFFALO FORGE CO.

It is the practice of the Buffalo Forge Co. to call its representatives to the home office at least once a year for consultation and advice. Of course they cannot all come at once but sometime during the year the representatives in Europe and elsewhere run home for a brief call. At the annual meeting the representatives in the branch offices in the United States are called together for a week's consultation. The 1902 meeting was recently held. At these meetings papers on technical subjects are prepared and read by the representatives, all bearing upon the business of the company, and it can well be imagined that from such a system something of value must be adduced. All these representatives are engineers. They are, in fact, salesmen engineers. Articles upon heating and ventilating installations of different characters and, in short, fan-system applications to a large variety of industries were read at the 1902 meeting. The development and perfection of the fan, and its application have been so rapid that the United States leads the world in efficiency of heating and ventilating equipment. A large proportion of this work is done by the Buffalo Forge Co. The company is planning at present to erect an entirely new plant, as its present one is inadequate. Among its manufactures are high-speed engines of various kinds, horizontal, vertical and marine, simple and compound; a multitude of applications of the Buffalo fan system of heating, ventilating, drying and cooling; steel-plate fans of many types; steel pressure blowers for cupola and high-pressure blast service; blowers and exhausters; planing-mill exhaust fans for carrying smoke and shavings to any point; disk wheels for ventilating, cooling and drying; the down-draft forges, which have made the company widely known, and which, by carrying smoke and gases away by down-draft suction into underground tile pipes, do away with the necessity of overhead piping; hand blowers and portable forges of all kinds; and blacksmith drills, tire-benders and other tools.

TRADE NOTES.

The American Steam Gauge & Valve Mfg. Co., Boston, Mass., have just issued a striking calendar devoted to their specialties.

M. W. Fogg, No. 20 Fulton street, New York, manufacturer of cushions, mattresses and marine upholstery, will remove to the new building at No. 202 Front street, near Fulton street, within a few days.

Charles P. Willard & Co., Chicago, Ill., have just issued a catalogue devoted to their marine engines and boilers. They are builders of marine engines, marine boilers, yachts, tugs and river steamers. The company has erected a large machine and boiler shop, with pattern and pipe shop at Winthrop harbor, Ill.

J. A. Fay & Egan Co. of Cincinnati, O., the large manufacturers of standard wood-working machinery, have just opened a new branch office at 69 Chapin block, Buffalo, N. Y., in charge of Mr. B. E. Crafts, who will at once enter into active business operations to further the interests of the company. Mr. Crafts has heretofore represented the firm as salesman for that territory, but the continually increasing business of the company necessitated this new move, which will better enable them to cater to the wants of the users of wood-working machinery.

The Standard Pneumatic Tool Co., Aurora, Ill., has appointed Mr. J. B. Wilson, formerly connected with the mechanical department of the Grand Trunk railway, as manager of its new Canadian offices, which it has just opened at 103 Union Station Arcade, Toronto, Ont. The company will carry a full line of "Little Giant" pneumatic tools and appliances, repair parts and accessories. In the future all machines for Canadian customers will be shipped direct from the Toronto office, thereby saving purchasers the inconvenience of making out manifests and paying duty. The company reports that its business in Canada has greatly increased during the past few months and that the outlook is very encouraging.

U. S. Engineer Office, 1637 Indiana Ave., Chicago, Ill., January 27, 1902. Sealed proposals for dredging at Calumet Harbor, Ill., will be received here until 12, noon, March 5, 1902, and then publicly opened. Information on application. O. H. Ernst, Lt. Col., Engrs. Feb. 27.

U. S. Engineer Office, Buffalo, N. Y., February 1, 1902. Sealed proposals for removal of wreck in harbor at Buffalo, N. Y., will be received here until 11 A. M., March 4, 1902, and then opened. Information furnished on application. T. W. Symons, Major, Engrs. Feb. 27.

Sealed proposals will be received at the office of the Light-House Engineer, Buffalo, N. Y., until 12 o'clock noon (standard time) of Friday the 28th day of February, 1902, and then opened, for constructing two beacons, one lantern and a fog-signal house, including foundations and protection work, in main south entrance of the new breakwater at Buffalo, N. Y., and one beacon on the south end of the New North Breakwater, main entrance to Buffalo Harbor, New York. Blank forms of proposal with specifications and plans, may be had on application to Major T. W. Symons, U. S. Engineer, Tenth Light-House District. Feb. 13.